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SCIENCE DIGEST

WE CAN CLEAN UP OUR AIR

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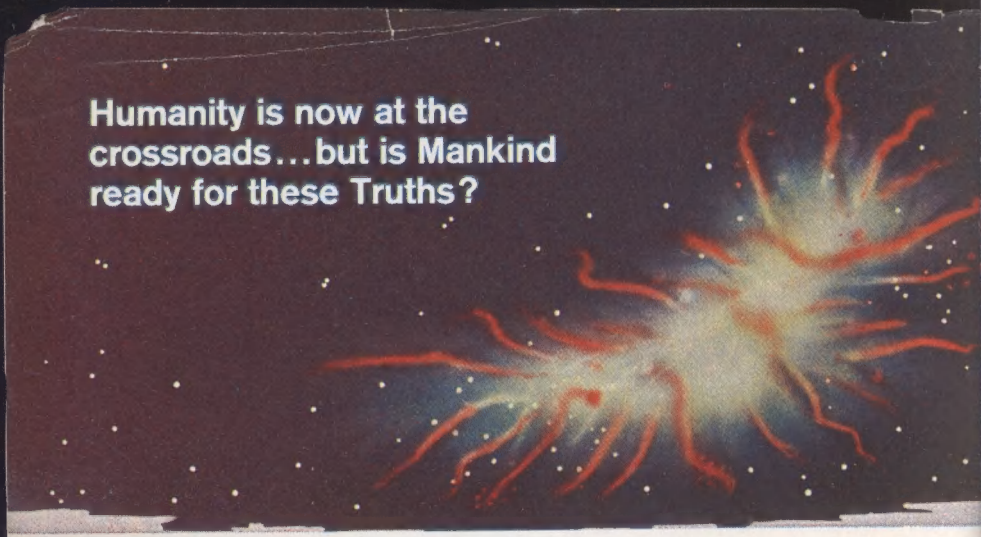
NEW FEATURE: Your Science ABC's

RUSSIA'S HIDDEN SCIENCE CITY

The man who explained the atom

Why so many of us are tired



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SCIENCE DIGEST

Twenty-seventh year of publication

VOL. 53, NO. 5

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ARTICLES

FEATURES

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Cover picture of Henry Kaiser—Camera Hawaii

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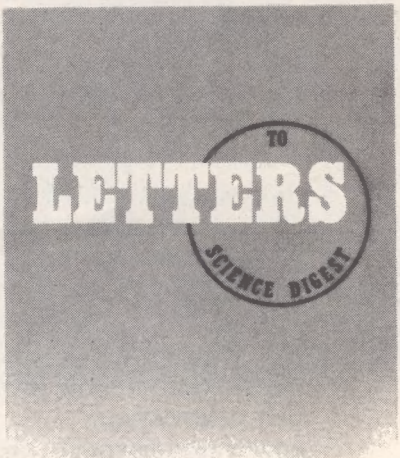


MD Drug: How Good?

I noticed the statement made in "The Progress of Medicine" by Arthur J. Snider, "Drug Delays Course of Muscular Dystrophy" (March '63). There is a very definite misinterpretation of the results of Dr. Robert M. Dowben, of Northwestern University.

It has been determined with extensive research, beginning in 1961 and recently completed, in a group of over 40 patients with many types of muscular dystrophy, that no significant improvement, either subjective or objective, was seen in patients receiving the type of treatment outlined by Dr. Dowben. It is true that some of the adult patients had some increase in body weight and appetite, but this was the only change.

These findings were particularly noticed in our Muscular Dystrophy Clinic at Detroit Memorial Hospital. In an additional study carried out in England at Kings College no significant changes were noticed with reference to muscle strength or functional capacity in 38 patients. There-

fore, it would be logical at this time to bring to the attention of readers that the muscular dystrophy course is not delayed by the particular type of outline of management represented by Dr. Dowben, in terms of any chemicals used in the treatment of muscular dystrophy. It is true that with use of physical therapy procedures, it is possible to delay and somewhat modify muscular dystrophy.

M. K. NEWMAN, M.D.,
Medical Director
Muscular Dystrophy Clinic
Detroit Memorial Hospital

The article was based on material released by the Northwestern University Medical School and approved by Dr. Dowben. The results are presented as Dr. Dowben interpreted them—ARTHUR J. SNIDER.

Heat of the Earth

In your interesting article "Can Science Offset the Population Explosion?" (Feb. '63), it appears that Dr. Weinberg has not considered one of the most abundant sources of energy —the internal heat of the earth, caused by the gravitational pressures. That energy, once tapped, should be one of the simplest to convert into useable power and it would appear to be more economical than "burning rocks." Perhaps project "MOHO" will supply the answer.

J. W. R. BOURNIER
Santa Cruz, Calif.

Lasers in Space

I have read your article "Destroying Enemy Satellites," (March '63) and wondered about the glaring omission of any mention about the possibility of employing laser beams to destroy enemy spacecraft. If this method does prove feasible, how long would it require for this type of defense (or offense) to become operational? Also does the Soviet Union presently have any comparable system in developmental stages?

LARRY KATZENSTEIN
Salem, Ill.

Although there has been some talk of using lasers as "death rays," the instrument is still pretty much in the research and development stage. Any speculation on when or even if such a system will become operational is premature. The Soviets are probably behind the U. S. in laser development —EDITOR.

Autistic Children

In "What's On Your Mind," (March '63) there was an item on autistic children. I was both surprised and somewhat horrified by the existence of these children. Because of my interest in this topic I would like to use it for my senior oration.

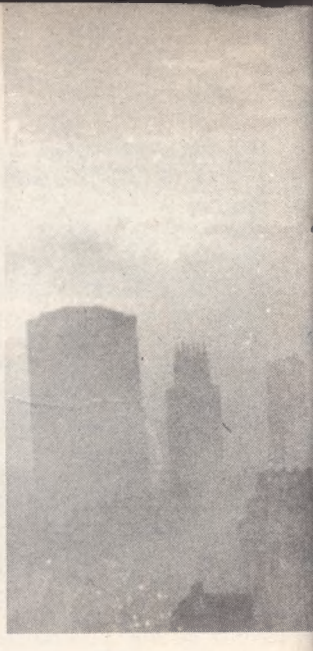
May I add that I think that your magazine is just great. I have found information which has been of great help to me in my science reports. Your magazine has also helped me to decide on my major for college.

CAROL A. BADWEY
Altoona, Penna.

Tops

Please don't assume that I write you to see my name in *Science Digest*. One of my grandsons used *Science Digest* in his night school and recently was taken from the branch to the management offices of the Boeing Co. He thinks the magazine is tops.

CARL R. BERG
Bainbridge Island, Wash.



the filth we breathe

How many more will it kill?

Every community with 2,500 or more people suffers from air pollution. It is late—not just discomfort, but disease and death now threaten us.

ALMOST too late, we are awakening to the alarming facts of air pollution. From an occasional disaster . . . such as London's 1952 killer smog which resulted in 4,000 excess deaths, and our own Donora, Pa., incident in which 13,900 were sickened . . . we have arrived at a situation of nationwide menace.

Over 150 million tons of pollutants spew forth into our air each year in the form of dangerous gases, dusts, and fumes. The 15,000 quarts of air that each citizen breathes daily bring into the delicate tissues of bronchial pathways and lungs a portion of these contaminants, their deadly effect masked in every type of respiratory ailment from asthma and bronchitis to lung cancer.

Wide World

Air pollution has already become a major problem in America's largest city—New York.

Only if air pollution illnesses were made a reportable disease could we get an idea of the extent to which the nation's health has been damaged. Even so, we do know that, as of right now, every community with 2,500 or more people—90 percent of the nation's metropolitan population—suffers from air pollution.

We already know enough—*right now*—to reduce pollution to bearable proportions.

Then why have we not done so?

Many fingers point at many culprits. For instance, an enormous portion of the air's filth admittedly comes from the smokestacks of industry and from the exhaust pipes of 70 million cars and trucks on the roads.

Government, too, is guilty of polluting the air. Municipalities over the nation, declares Arthur Benline, commissioner of air pollution in New York City, foul the atmosphere with contaminants from incinerators, huge public housing projects, and from asphalt, sewage disposal and power plants.

Most to be condemned, perhaps, are those public officials whose duty it is to pass legislation to cope with air pollution.

What is needed? Here, five people who know the dangers give their opinions.

Why Washington must step in

Congress has yet to face the fundamental issues: (1) Money, and (2) Enforcement of air pollution control. At some point, action must begin and money must be spent.

It is clear that, if effective action is to be taken, the federal government will have to exercise far greater leadership than it has assumed to date. The federal government must recognize that state and local officials are often vulnerable to threats by air-polluting industry to move to a community where, they say, public officials "are more understanding."

A number of attempts were made last year to get bills passed by Congress which would have made a good start in this direction. Those introduced by Senator Clair Engle of California and Representative George M. Rhodes of Pennsylvania specifically declared that the federal government has "an obligation to provide leadership in the initiation of national programs of research and development necessary to the ultimate prevention and control of air pollution."

Unfortunately these bills failed to pass. Another bill introduced by Senator Maurice B. Neuberger of Oregon and co-sponsored by myself, would have provided financial assistance, in special circumstances, for the actual construction of pollution control facilities.

This bill, too, failed to pass.

I sincerely hope that these bills will again be introduced and that sufficient political statesmanship will be gathered behind them so they may be enacted. Men with political statesmanship in Congress must be the ones to get such legislation approved and made into law.—*Sen. Harrison A. Williams, Democrat, New Jersey.*

What the doctor can do

Acute smog disasters and chronic smog problems in our large cities, have prompted intense medical research into the complex relationships between air pollution and pulmonary function and disease.

So far these relationships have not been completely verified, but the evidence is sufficiently incriminating to predict some symptomatic air pollution-related disease.

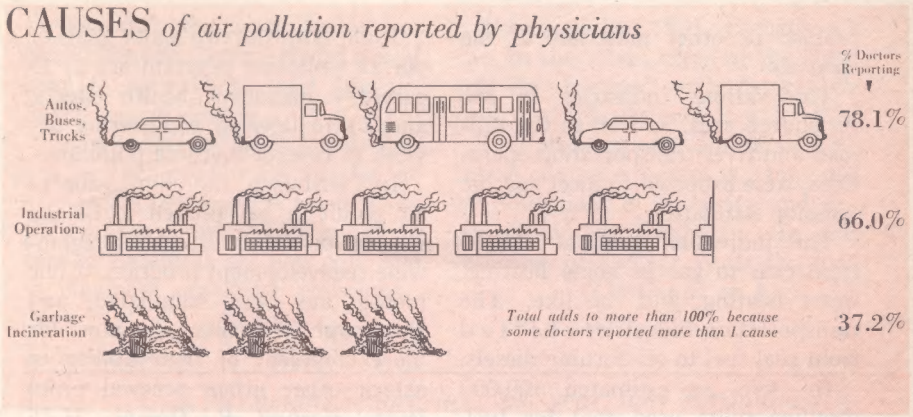
This has aroused many physicians to greater participation in actual control activities. In some regions doctors have helped in establishing air quality standards.

There are two kinds of polluted air: London-type; Los Angeles-type.

In London, coal is the basic fuel. Sulphur dioxide, escaping from the burning coal, mixes with air and produces sulphur trioxide which, when moisturized, is transformed into sulphuric acid. When it is foggy, the necessary moisture is present to pollute the air.

Los Angeles smog is caused by the almost continual sunlight. Nitric oxide, released into the atmosphere, combines with oxygen to produce nitrogen dioxide. Under the glare of the Los Angeles sun, the nitrogen dioxide molecules break down, releasing large amounts of poisonous ozone. In auto-infested Los Angeles, the ozone combines with the unburned gasoline in auto fumes to form other dangerous contaminants.

The private physician can treat his patient for a lung ailment, but he cannot, by himself, clear up the air



New Medical Materia

What pollutes the air? In a survey, physicians blamed these as the major causes.

pollution which may be responsible. However, each individual physician can learn what the problems are and point these out to his community.—*Millard B. Bethel, Director, AMA Department of Environmental Health.*

How Pittsburgh licked the problem

In 1940, air pollution was a serious threat to the economic future of the Pittsburgh region. Thick smogs hung almost continually over its deep river valleys, giving it worldwide notoriety as "the smoky city." Civic pride was almost unknown.

Just when it appeared that the city and region faced an inevitable decline, vigorous civic and political leaders initiated a long-range program to reverse the backward drift and to revitalize the community.

The important lesson to be gained from the Pittsburgh experience is that air pollution control requires the mutual cooperation of local government, industry, and medicine.

Here's how Pittsburgh attacked the problem of smoke: In 1941, an improved anti-smoke ordinance was enacted.

Industry was brought under the anti-smoke law in October, 1946. A year later, the law was extended to private homes in the city.

In 1947, the Pennsylvania State Legislature gave the go-ahead to extend the benefits of clean air to all of Allegheny County. A county-wide law was enacted in 1949 and Allegheny County was on its way to achieving one of the most successful air cleaning programs in history.

Under the Pittsburgh and Allegheny County ordinances, individual home-owners were required to burn so-called "smokeless fuels," unless they used mechanical solid fuel-burning equipment. Residents were also prohibited from burning

rubbish or other materials in the open air.

The various industries in the Pittsburgh area, as well as the railroad and river transportation operations, were expected to meet specific emission standards.

The individual resident shifted from coal to gas in home heating, water heating, and the like. The transportation industries shifted from coal fuel to oil-burning diesels.

In 1946, an estimated 300,000 dwelling units used coal for fuel. Today, according to reliable estimates, only 9 percent (about 36,000) of 400,000 dwellings are using coal—a reduction of 85 percent over 13 years.

The figures for the railroad and river traffic are even more dramatic. All locomotives and boats have been dieselized. This results in about a hundredfold reduction in the emission of cinders, fly ash, and smoke per unit.

During the initial phase of the program, the economic and social aspects of air pollution took precedence over public health concerns.

In recent years, however, the health effects of air pollution have occupied an important place in the program.

Our main emphasis, in fact, is no longer "clean" air, but "healthy" air. Just because the air *looks* pure, doesn't mean it is. It is often filled with numerous invisible pollutants, such as sulphur compounds and various hydrocarbons. We are now measuring the incidence and effects of such "invisible" pollution.

Right now, the two major goals of our air pollution program are 1) to carefully document health effects, and 2) to develop engineering devices to control invisible pollutants.

In Pittsburgh, the elimination of air pollution has proved to be the foundation for a dramatic, region-wide redevelopment program. Civic morale has been stimulated, and Pittsburgh residents are now far more confident of their ability to attack other urban renewal problems.—*Herbert R. Domke, M.D. Director, Allegheny County (Pa.), Health Dept.*

New hope for Californians

California now has more people—17.3 million—then any state in the union. It also has the greatest mileage in freeways, and the most autos.

There are now 9,109,902 autos in the state, as compared with 5,617,007 ten years ago. It is estimated that the 3.5 million motor vehicles in Los Angeles County alone pour 1500 tons of hydrocarbons, 450 tons of oxides of nitrogen, and about 9,000 tons of carbon monoxide into the air daily.

Recognizing that Los Angeles County's photochemical smog was caused primarily by the emission of auto fumes, the state legislature enacted a bill in 1960 which required most automobiles in the state to be equipped with exhaust devices.

However, the bill also stipulated that, before California cars could be

so equipped, the State Motor Vehicle Pollution Control Board would have to approve at least two exhaust control devices.

Some reduction in auto emissions has been achieved by the installation of systems that control fumes from the crankcase vent. Over a million cars in California are now equipped to eliminate crankcase emissions.

By the end of 1965, virtually all cars in the urban areas of the state will be equipped with devices to control crankcase emissions.

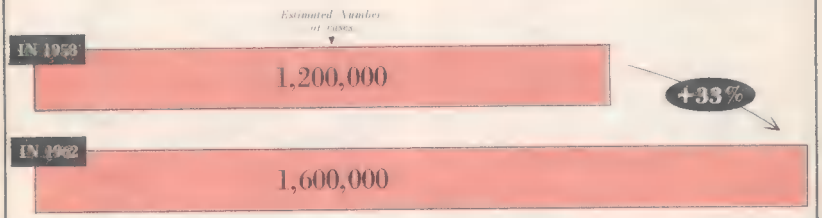
California's motor vehicle air pollution control program is hampered by limitations of authority and decentralized responsibility. In the interests of greater centralization,

(Continued on page 11)

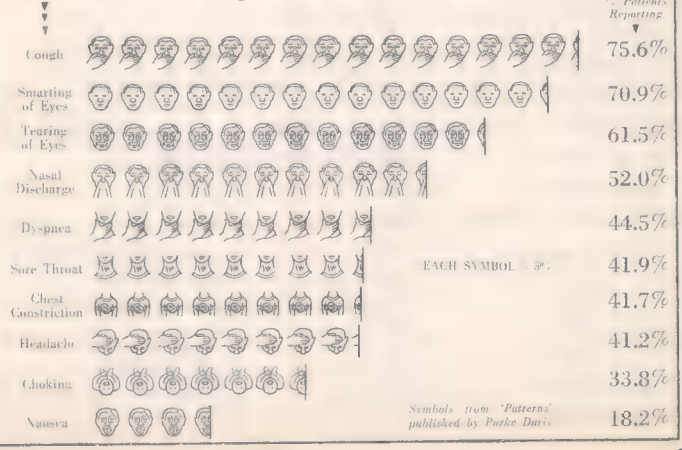
New Medical Materia

U.S. physicians report that, last year, they encountered

1,600,000 CASES *in which air pollution figured*



SYMPTOMS *reported by patients*



HOW BAD IS YOUR CITY'S AIR?

Figures in column 1 indicate micrograms per cubic meter of solids suspended in the air. Column 2 figures indicate micrograms per cubic meter of organic matter. First line shows the national averages.

Cities	Pendent Solids	Organic Matter
ALL U.S.	104	7.6
ALA: Birmingham	126	9.7
ALASKA: Anchorage	83	5.2
ARIZ: Phoenix	207	13.9
ARK: Little Rock	74	6.0
CALIF: Berkeley	79	6.1
Los Angeles	169	19.2
Sacramento	76	7.9
San Francisco	66	6.6
COLO: Denver	110	10.3
CONN: Hartford	89	7.7
New Haven	85	7.9
DEL: Wilmington	175	11.9
D.C.: Washington	108	11.6
FLA: Jacksonville	94	9.7
Miami	56	5.3
GA: Atlanta	99	9.5
HAWAII: Honolulu	49	3.9
IDAHO: Boise	105	9.0
ILL: Chicago	187	14.2
IND: Gary	224	12.3
Indianapolis	162	14.0
IOWA: Des Moines	150	8.2
KANS: Kansas City	110	7.9
Topeka	91	5.0
KY: Louisville	132	9.1
LA: New Orleans	89	9.4
ME: Portland	85	6.7
MD: Baltimore	132	11.4
MASS: Boston	131	11.2
MICH: Detroit	134	9.5
MINN: Minneapolis	94	6.0
MISS: Jackson	73	5.3
MO: St. Louis	160	11.7
MONT: Helena	55	2.2
NEBR: Omaha	106	7.0
NEV: Las Vegas	147	7.6
N.H.: Manchester	59	6.0
N.J.: Camden	165	9.8
Jersey City	154	11.6
Newark	97	9.0
N.MEX: Albuquerque	183	11.8
N.Y.: Albany	59	3.1
Buffalo	103	5.0
New York	169	13.0
Syracuse	115	8.0
N. CAR.: Raleigh	71	6.0
N. DAK.: Bismarck	80	3.6
OHIO: Cincinnati	128	8.8
Cleveland	155	10.8
Columbus	129	9.0
Dayton	113	8.3
Toledo	104	7.2
OKLA: Okla. City	78	6.6
Tulsa	66	2.8
ORE: Portland	76	6.9
PENN: Philadelphia	163	10.7
Pittsburgh	160	10.5
R.I.: Providence	100	8.9
S. CAR: Charleston	64	5.2
S. DAK: Sioux Falls	81	4.4
TENN: Chattanooga	190	17.9
Memphis	93	8.1
Nashville	127	11.5
TEX: Austin	77	5.4
Dallas	95	7.6
El Paso	147	5.1
Fort Worth	82	6.8
Houston	104	6.8
UTAH: Salt Lake City	109	9.4
VT: Burlington	51	2.9
VA: Norfolk	96	7.9
Richmond	83	7.6
WASH: Seattle	79	6.2
Spokane	106	8.0
W. VA: Charleston	171	8.1
Wheeling	184	13.7
WISC: Madison	79	5.7
Milwaukee	139	7.9
WYO: Cheyenne	40	3.2

(Continued from page 9)
the Los Angeles County Board of Supervisors and the County Supervisors Association of California have proposed legislation to create a State Department of Air Pollution.

The proposed new laws would broaden the authority of the Motor Vehicle Pollution Control Board to approve acceptable emission-control devices; require public hearings on the adequacy of vehicular emission standards; and make provisions for periodic vehicle inspection.

California has poured over $130,000,000 to date into the battle against smog—more than any other state—but the problem is far from solved. While much has been accomplished in controlling stationary pollution sources, the California air pollution control program has as its remaining goal: to control the air pollutants from the use, storage, and transportation of solvents; to detect suspected but as yet undiscovered sources of contaminants; to insure continued compliance by industry.

And, of course, to eliminate the outpouring of pollution from motor vehicles.—*S. Smith Griswold, Air Pollution Control Officer, Los Angeles County.*

But only you can end pollution

Although we will always need policemen, general good behavior can never be achieved by policing alone; witness prohibition. It is essential that most citizens, or most industries, should want to behave themselves, either voluntarily, or because of what the neighbors will say.

Many physicians know from their own experience, and others from having read Rachel Carson's book, *Silent Spring,* that the U.S. Public Health Service and Department of Agriculture have polluted the atmosphere, and encouraged its pollution over vast areas, with highly toxic insect sprays. Since, in general, these agencies have refused to acknowledge such damage, they can hardly be trusted to police their own violations.

We are like children playing with matches. No one knows the possible long-range effects, and often not even the immediate harm, that may result from the various things we are doing to nature and to the environment in which we live.

Often we must choose whether we will do without some new benefit or accept the hazard of air pollution; insofar as is possible, this should be a deliberate and informed choice and we should not blind ourselves to the costs that may be involved.

Meanwhile, we should remember that there is good reason to mistrust the competence and single-mindedness of those entrusted to protect us. Good machinery for pollution control is useless without an informed and alert citizenry.

Unless we, as citizens, take an active and informed interest in our own protection against air pollution, we are headed for serious trouble. *Frederick B. Exner, M.D., Seattle, Wash., writer on public health issues.*

Nature's weirdest inventions

by John Sidney

Meet a snail with
14,175 teeth in its tongue,
an oyster that lays
500 million eggs a year,
a frog that can "fly"
and a bird that walks under water.

All photos American Museum of Natural History

His tongue is rooted in his chest.

EVERY creature is astonishing in its own right. But there are some that really pull out all the stops.

Consider, for example, the black swallower fish of West Indian waters. This herring-sized fish, *Chiasmodom niger,* frequently makes a meal of a fish three times as large as itself. It does this with an elastic stomach which stretches to hold the catch and afterwards digests it leisurely.

In the same class is the smoky jungle frog of South America which, though it weighs only about a pound, can capture and eat a tree snake five feet long. It traps snakes with its strong tongue which lashes out like a lariat and winds round the victim's head. Then the snake's head is swallowed and the frog eats its way along the snake. The wriggling victim may live for some hours before it finally suffocates. The frog swallows a portion and waits for the digestive juices to do their work. A captive frog once ate five feet of tree snake in under two days.

Frogs' tongues are remarkable in their own right. Their sticky tongues are rooted at the front of

the mouth to gain extra length in snatching insect prey. Then there is the chameleon's which is twice as long as its owner and the gecko lizard's which is so long that the reptile uses it to wash its eyes. The okapi also puts its long tongue to eye-cleansing purposes. But the king of tongues is certainly that of the South American ant eater. Its tongue, which penetrates deep into ant hills, is rooted not in the mouth or throat but in the breastbone.

Other astonishing tongues also have the functions of teeth. The penguin's tongue is spiny to help hold slippery fish; the flamingo's spiky tongue acts as a strainer when it gobbles up a mouthful of muddy water and strains out the crustacea and other tiny water creatures that it eats.

The utmost in dual purpose tongues is that of the common garden snail. When it opens its jaws to nibble our tender seedlings, a multiple-toothed tongue goes to work. Moving from side to side and acting like a rasp, the tongue with its 135 rows of 105 teeth—14,175 in all!—shreads the leaf into fine pieces.

41,000 eggs a minute

Sea creatures are prodigious egg-layers. They have to insure the survival of their species despite many enemies which prey on the eggs and the emerging young. The blue ribbon goes to an American oyster which lays about 500 million eggs a year. This record is approached by some of the sea-hares, or shell-less snails. One was observed to lay eggs in bead-like strings at the rate of 41,000 a minute—and 480 million eggs in four months.

Many birds hunt their prey in water but the water dippers hunt underwater. They don't dive in as most birds do but stroll down into a stream and walk or "fly" nonchalantly along the bottom seeking their insect prey.

The dippers are water-proof—their feathers are so heavy and well-oiled that their bodies don't get wet.

From one pole to another

Faultless navigation over thousands of miles is the accomplishment of many birds. Arctic terns make a round trip of about 22,000 miles a year, from the pack ice of the Arctic Circle to that of the Antarctic. In this way, they enjoy both polar summers. But the apex for instinctive navigation over featureless seas goes to the young shearwater which was taken from its burrow on the island of Skokholm, off the Pembrokeshire coast in Britain, and released 3,050 miles away in Boston. It was back home in 12½ days, beating by almost half a day a letter informing a British scientist of its release. Phenomenal, too, was the alpine swift from Germany which was released in Lisbon and was back in its home 69 hours later.

Mammals, too, can find their way home over long distances. A Ger-

man cavalry horse taken by train from the military stables in Potsdam to Hirschberg broke away and was back in its Potsdam home, 155 miles away, in five days.

In tests, dogs have shown comparable skill, but over shorter distances. A German dog called Nora was released in a part of the city of Munich that it was unlikely that she knew. After some indecision, she set off homeward, spent some time playing with other dogs and reached it in just over two hours, having covered 5½ miles. Forty days later she was released in the same place. She was home in 35 minutes. But this time

He flies about 22,000 miles a year.

she took a different and shorter route of about three miles.

Nature has produced some notable jumpers. Kangaroos can clear up to 30 feet and gazelles up to 40 feet. But pound for pound, the 5 inch-long jerboa of Africa is the preeminent broad jumper. In a single leap it can cover 15 feet.

There are some pretty good sprinters too. Pronghorn antelope have been timed at 60 m.p.h. and

One beat the mails by almost half a day.

blackbuck at 65 m.p.h. But topping them is the lithe cheetah which has been clocked at over 70 m.p.h.

In the air the apex in speed is probably achieved by the Indian swift. In level flight over a two-mile stretch this tiny bird hit 200 m.p.h. No other bird approaches this, even in a dive, but in a plunge downwards after prey a goshawk can hit 180 m.p.h.

Tree frogs which have suckers on their feet are marvelous acrobats—they need to be to avoid tree snakes—but, again, Nature has its "greats." These are the so-called flying frogs which can glide considerable distances to avoid snapping jaws. The flying frog of Java has extensive webbing between the long toes of its front and hind feet and spreads them wide to parachute to safety. It can sail 40 feet or so—a feat almost equalled by some tropical gliding frogs in India.

Another remarkable glider is

draco volans, a tiny brightly colored Asian lizard which has a broad membrane on each side of its body. This it can spread with long, slender ribs. Draco is a tree-dweller and moves along the branches with its "wings" folded in search of insects. When it sights a butterfly below, it leaps off and spreads the membrane to glide down on its victim. Leaps of 20 feet from limb to limb are all in the day's work for this foot-long reptile.

The elephant trunk is an engineering miracle. This wonderful limb has 40,000 muscles. It is the strongest limb in nature and yet can be wielded with the greatest delicacy.

Foot-long bill

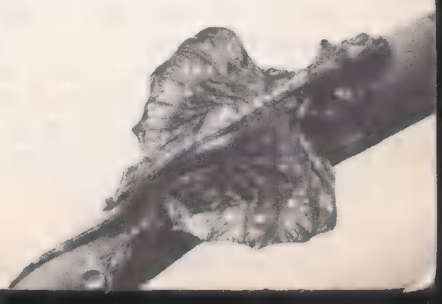
The whopper in bird's bills is the foot-long one of the great hornbill of India. This black and white bird carries all before it in the form of a huge yellow beak, which surprisingly weighs only a few ounces. It's not solid but consists of hundreds of tiny hollow cells.

Many creatures have truly remarkable eyes. An eagle gliding at 1,000 feet, with its keen telescopic vision, can spot a rabbit crouched in the grass below. An owl can fly unfalteringly on the darkest night because its eyes gather 10 times as much light as ours do. Rabbits have bulging eyes and can watch what is happening behind them. Yet all these eyes are ordinary compared to those of Anableps, a tropical fish which has dual-purpose eyes. It can see at the one time what is happening in the air and in the water. This is an astounding feat because vision in air demands a lens with a short focal length and water vision, a long one. Anableps, which swims along the surface with the top halves of its eyes out of the water, achieves this optical feat by means of two pupils in each eye.

There are some wonderful hunters in the world. Some such as the tiger or cheetah kill with flashing speed; others such as the spiders use guileful webs. But even among spiders there are superlatives. There are, for instance, the nocturnal net-casting spiders which make snares about the size and shape of a postage stamp. When an insect approaches, the spider gathers the snare in its four front legs, races forward and throws it over the prey. Most net-casting spiders dine on the spot and swallow the snare, too, when the night's work is done. But one thrifty Brazilian hunter throws the snare and catch over his shoulder and takes them home.

Other strange spiders are those which fish for their living, dangling a seductive globule of syrup on a

Butterflies are easy prey for him.



short line. When a moth is lured near, the spider swings the sticky bait towards it. Once stuck, the moth has little chance; the line is so elastic it will stretch to more than twice its length without breaking. Eventually the moth tires and is reeled in and eaten.

Size? Here, too, there are the great ones. Blue whales may grow to 110 ft. and weigh 140 tons. Nothing bigger than these whales has ever existed on earth, even in prehistoric times. The giant diplodocus does not appear to have been longer than 90 feet. Moreover, it had a comparatively slim neck and tail and weighed about a quarter or a third as much as the great whales. Whales, too, produce the biggest babies. A new-born baby is about half the length of its mother.

Beetles include some of the tiniest creatures, but there is one that is really a whopper—the 6 inch long Hercules beetle of South America. It looks much like a crab's claw on legs. Two huge horns, each four inches long, project vertically from its body. One curves up from the thorax and the other on the back curves downward. With serrated edges, these curved, meeting horns are a deadly tool when the Hercules beetle emerges at night to prey on insects.

Dig that 'third sound'

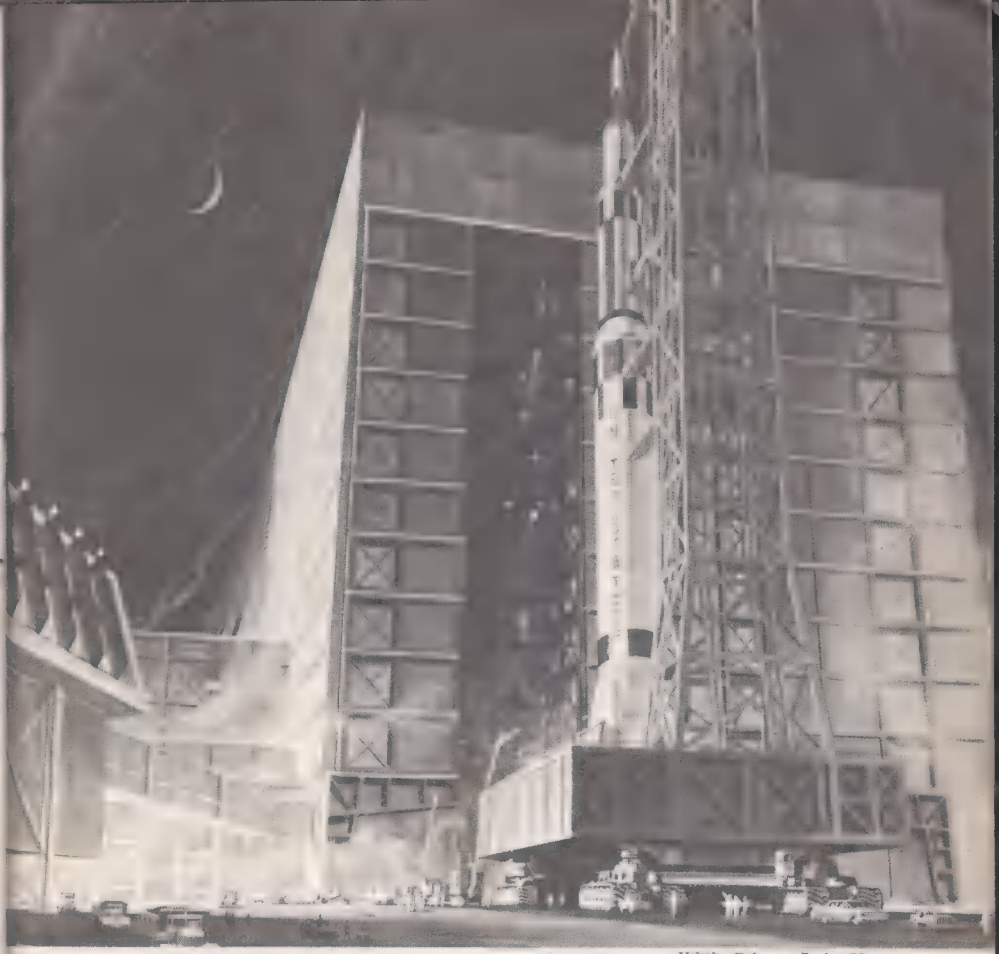
THIRD SOUND is not a jazzman's phrase for a new musical idiom. It is, however, related to the sounds of music, which are caused by variations in the density of a medium such as air, and called by physicists "first sound." Next in this unusual series is "second sound," a wave in which the oscillating variable is temperature.

Although the existence of "third sound" was hypothesized by physicist Dr. Kenneth Atkins of the University of Pennsylvania a number of years ago, it was only recently produced and observed for the first time. Third sound resembles an ocean wave skimming along the surface of a film of liquid helium only one millionth of an inch deep, the thickness of 100 atoms.

Obviously, third sound exists only under unusual conditions. These are created by cooling helium to —458° F., where it liquifies. The liquid helium is poured into a container over which a small mirror is placed. At the —458° temperature, a thin film of helium atoms forms over the mirror. The film of atoms forms on all surfaces and can flow up the side and over the rim on the container.

The film of helium over the mirror is churned into a wave by blinking a light some 100 times a second onto the mirror by means of a revolving disk. Polarized light is then used to observe the oceanlike behavior of the wave. This wave is third sound.

"We are exploring the possibilities of this film," Dr. Atkins said. "The microscopically thin wave is similar to an ocean wave. This is unusual because, in a normal liquid such a wave cannot be formed on a film of liquid this thin. The viscosity of a normal liquid would damp the wave down. Liquid helium, on the other hand, is a superfluid possessing no viscosity, or resistance to motion."



Urbahn-Roberts—Seelye-Moran

These doors are 45 stories high

Standing over 500 feet tall and covering more than 10 acres, this structure is being designed to assemble and check out moon flight rockets and spacecraft being developed under Project Apollo. When completed, the building will accommodate 360-foot-tall moon vehicles. Measuring approximately 524 feet high, 674 feet wide and 513 feet long, the structure will enclose the greatest volume of any known building, 125,300,000 cubic feet, more space than the Great Pyramid of Cheops. The 45-story-high doors will set another record. They will cover a portal 456 feet high, 74 feet wide at the top and 152 feet wide at the bottom. They will be able to operate in 63 mph winds. After the vehicles are checked out they will be transported three miles to the launch pad. The facilities are being designed for Cape Canaveral by a combine known as Urbahn-Roberts-Seelye-Moran.

He's a whiz at work but a mess at home

ONE type of neurotic behavior can be helpful to an executive in the office, but can create a lot of other problems for him.

The trait is "neurotic competitiveness," says Dr. C. Knight Aldrich, Professor and Chairman of the Department of Psychiatry at the University of Chicago.

But if the intensely competitive businessman has some understanding, flexibility, and persistence, he can solve at least some of the problems this trait causes, the psychiatrist says.

Everyone has some unsolved early conflicts that manifest themselves to some degree in neurotic symptoms, Dr. Aldrich points out. Most of these symptoms are more of a hindrance than a help, but there are a few that can be put to good use in some circumstances, and within certain limits. One of these is intense competitiveness.

"If all other things are equal, the man with the greatest competitive drive, again with certain limits, becomes the greatest success. The 'normal' man whose past unsolved conflicts add a 'neurotic' component to his basic competitive drive has an advantage over his associates," Dr. Aldrich states.

"If, like the perfectionist who is nervous when things aren't perfect, he is nervous when he hasn't won the competition, he will work at it night and day and over weekends while his better adjusted competitor relaxes with his family.

"And provided that our neurotically competitive subject can restrain himself when to be openly competitive would be impolitic, there is no doubt of the outcome. The man with the single minded devotion to competition wins.

"His neurotic traits, therefore, pay off in the currency of the American ideal," Dr. Aldrich comments.

But there is a cost for this success.

Intense competitors have "more than their share" of ulcers, and the constant tension of competition can result in ills in other areas of the body as well. In addition, the "two packs a day and two Martinis before lunch" and other methods of counteracting tension also take their toll, Dr. Aldrich says. And when illness strikes, the competitive businessman

isn't likely to take good care of himself.

"Home for the neurotic competitor represents either no competition, which bores him; a handicap to his competitive efforts, which makes him nervous; or an alternative competitive field," the psychiatrist finds.

"To some extent he avoids the boredom by long hours of work and evening meetings, and he expresses his tension by irritability. His domestic competition is more complicated. His wife often seems to represent a beautiful and talented prize he won in competition with other men; once he's won her, he's not so sure he knows what to do with her."

A third area where the competitive personality may face difficulties is in retirement. He has nothing to substitute for real competition, the psychiatrist notes, and he becomes bored and depressed.

There are ways to solve these problems, if the neurotic competitor is willing to work at it, and if he understands the nature of his drive. "However, insight into an emotional problem does not automatically relieve the problem," Dr. Aldrich added.

Relief for the neurotic competitor, at least on a permanent basis, usually requires a long and tedious, and usually painful procedure. The fact that society rewards the neurotic competitor so lavishly certainly does not encourage him to undertake this procedure which, if successful, will reduce his rewards, Dr. Aldrich concludes.

EMOTION BEHIND THE WHEEL CAUSES TRAFFIC ACCIDENTS

The teenager who breaks speed laws and causes accidents is often motivated by the suspicion that he is lacking masculinity.

Confusion and apprehension about sex, plus unresolved emotional problems of all kinds have a great deal to do with the behavior of adolescents behind the wheel, according to a psychiatrist who has investigated the backgrounds of a number of reckless drivers.

This applies not only to teenagers, but to "adolescents of all ages, even unto the eighth decade," says Dr. Jerome Kummer, of the department of psychiatry at the University of California Medical Center in Los Angeles.

The culture pattern that creates such attitudes has come down to us from the turn of the century, when the automobile was first introduced, Dr. Kummer believes. Among social factors existing at that time he lists: Insufficient outlets for stronger feelings, including anger and aggression; confusion about sexual drives and acceptable outlets for them; "a man was not a man unless he could hold his liquor," and the law was for "the other guy," and

one wasn't really breaking the law unless he was "fool enough to get caught."

Second only to the culture pattern, Dr. Kummer lists the direct influence of family upbringing as a factor in development of the anti-social driver.

"It has been found," he says, "that persons who have received extremely strict and uncompromising treatment in their growing up years, just as those who have experienced overly permissive 'neglect,' account for a large percentage of problem drivers."

The former group, he says, "can be characterized as immature and insecure." The automobile is to them a "symbol of masculinity, mastery and power" that helps restore emotional equilibrium.

Dr. Kummer feels that such problem drivers generally resist psychiatric treatment. "It would seem," he concluded, "that the most satisfactory means of dealing with chronic problem drivers is to keep them away from driving."

WANTED--PSYCHIC GUINEA PIGS

Creative persons describing their moments of high creativity sound a lot like individuals who have had telepathic or other "paranormal" experiences, says Dr. Gardner Murphy, director of research at the Menninger Foundation.

Dr. Murphy and his associates are beginning a three year study on the relation of extrasensory perception to creativity, and they are looking for subjects who are both creative and "paranormally gifted."

Creative people are relatively easy to locate. The investigators are first looking for persons who have recognized achievements for the creative work. People with "paranormal gifts" are more difficult to find.

"We have always learned a great deal in psychical research from the spontaneous reports of people to whom striking things have happened; both the usual "anecdotes" of seeming to be in psychical contact with distant persons, or having uncanny hunches as to what is going on at some distant point, or what will occur in the future," writes Dr. Murphy. The investigators are also looking for people who have already taken part in experimental tests of their paranormal abilities and have something definite to report.

"We shall also need whole families or working groups like groups of musicians, artists, engineers, religious or civic groups in which there is a high degree of morale, fellow feeling, *esprit de corps,* willingness to work together, and capacity to stimulate and be stimulated by one another.

Dr. Murphy urges persons or groups who fit this description to

write to him at the Menninger Foundation, Topeka, Kansas, and tell him what contacts there seem to be between their own creativeness and their own paranormal capacities, to relate anything which offers a hypothesis that could be systematically formulated and tested.

LET CHILDREN PAINT WHAT THEY SEE

Give a child a large blank piece of paper and crayons or paints and put him in a spot that can be easily cleaned, suggests Kathryn Pelphrey, art consultant for the Albuquerque public schools.

"Color books, number paintings, and kits of all kinds destroy initiative, originality, and self appreciation," she suggests.

When adults try to "teach" small children to make pictures that look "real"—to adults—they are saying in effect that the child's own ideas are no good, Miss Pelphrey says. A child does not see things as adults do, nor is his motor coordination sufficiently developed so that he is capable of making things look real. This does not bother him, until some adult tries to guide him. The child needs time to develop in his own way.

"The important thing," she says, "is not the finished product but what happened to the child while he was making the product."

SHORTER HOSPITAL STAYS FOR NERVOUS BREAKDOWNS

A person who has a nervous breakdown today may be hospitalized for only three to six weeks.

Modern treatments give the doctor a chance to handle the vast majority of conditions in a matter of weeks without risking the dangerous side effects that prolonged hospitalization can cause, write Drs. Jurgen Ruesch, Carroll Brodsky and Ames Fischer in the *Archives of General Psychiatry*. The doctors feel that patients need hospital care only when their behavior is acutely disordered.

The patient and his relatives are told at once that his stay will be limited to a few weeks. This gets across to the relatives the idea that the patient cannot be abandoned, and it impresses the patient that he will not be able to permanently adapt to the hospital, the doctors note. However after the patient is discharged he is urged to return to the hospital regularly.

A study of 219 patients who had received this type of treatment revealed that six months after discharge the social adaptation of the majority at least equalled their pre-breakdown condition.

This treatment program was conceived by the Langley Porter Neuropsychiatric Institute, San Francisco.

Russia's hidde

by Albert Parry

Rumors that Khrushchev was building a huge Science City in the middle of Siberia are true. Here is a look at the mysterious Akademgorodok and the powerful men who run it.

IN THE wild and swampy forests of Siberia, 2,000 miles east of Moscow, the Soviet Union is operating a gigantic and semi-secret Science City.

There is nothing quite like it in the world.

Right now there are 20 institutes of scientific research housed in the complex of squat, massive three- and four-story buildings that have been erected in the past few years.

A few months ago the staff of the Science City was given as 12,500. Ultimately a staff of 50,000 is planned.

Facilities now exist for research in: Thermophysics and inorganic chemistry, kinetics and combustion, hydrodynamics, automation and electrical measuring techniques, higher mathematics including cybernetics, geophysics and geology, genetics and experimental biology, medicine, applied mechanics and linguistics.

In addition, the newspaper *Sovetskaya Sibir'* boasted that there are 30 other scientific institutes in the vicinity of the Science City—a total of 50 such establishments, in the middle of Asiatic Siberia.

The city was constructed at top speed under the orders of Nikita Khrushchev, as part of the program to develop the Soviet Union's vast

n science city

Sovfoto

Apartment houses for scientists and technicians under construction (above) in Siberia's Science City. Trees of the Siberian forest can be seen in back of the buildings.

resources east of the Ural mountains.

It is also possible that military considerations played a part in this decision. For years Soviet science has been concentrated in European Russia, particularly in and around Moscow, Leningrad and Kiev. For safety's sake, in this nuclear age, it might have been considered wise to disperse some of these institutions farther east. From Siberia, Soviet science could also better impress Khrushchev's Asian neighbors, especially a restless Red China.

The beginnings of a plan for the city can be traced back to 1957 when the Siberian division of the Soviet Academy of Sciences was officially established. Novosibirsk on the Ob River was chosen as the division's headquarters. This city was founded as Novonikolayevsk in 1896, and served first as a camp for workers constructing the Trans-Siberian Railroad. Later it became a transit point for landless peasants streaming to the frontiers of Siberia's steppes. Two world wars and the sundry five and seven-year plans have transformed the former railroad camp into a giant city of one million inhabitants.

The Science City was built on a site cleared from the primeval forest 12 miles from Novosibirsk. Some of the institutes and their housing units stand flush against the tall trees at the edge of the forest. These trees protect the buildings from the northern winds, yet offer space for future expansion. Near by, the Ob River has recently been dammed to form a 125-mile-long artificial lake called the Sea of Ob, which supplies power for both Novosibirsk and the Science City.

The official Soviet name for the Science City is Akademgorodok—the Academy's Little City.

In Novosibirsk itself is a new University that trains some of the staff-men and women for the institutes. Besides the University there are 12 other schools of advanced instruction in Novosibirsk.

A special high school for teenagers gifted in mathematics is maintained. Admission to this school is by invitation, mainly as a result of Siberia-wide contests in which talented boys and girls are urged to participate. The Science City originated the contests and is in charge of them. Scientists from the city visit high schools classes to further inspire the chosen youngsters.

Recently the Soviets became indignant over the Western assertion that the Science City is secret and kept out of bounds to visitors from abroad. Journalist George Weller was particularly chided in *Sovetskaya Sibir'* and *Izvestia* for saying such things.

Soviet cybernetics expert Sergei L. Sobolev.
Sovfoto

Nixon, Stevenson visit

Russian writers point to the fact that in 1959 Vice President Richard M. Nixon and Vice Admiral Hyman G. Rickover visited the Science City; that Ambassador Adlai E. Stevenson passed through it some years back; and that, last year, former Senator William Benton was there, too. But during the visits of the first three the city was just beginning to be built, and there was hardly anything to be seen on its site. Benton remarked that he had told the Russians that "I had no training in science and I wouldn't recognize a secret if my nose were rubbed in it!"

Of the foreign scientists who have seen the Science City, most have been from the East European satellite countries. Some Americans and other Westerners have indeed been refused permission to visit Novosibirsk and its Science City. So the Science City is at least semi-secret. Why must the Russians deny this since on other occasions they do proudly say that they have secrets. Who hasn't?

Weller was also attacked for saying that some Russian scientists move to Siberia against their will. The truth is that many young Rus-

The Science City is near the fast growing Siberian city of Novosibirsk.

sian scientists clamor to be assigned to the Science City. For a while going to Siberia's Science City was a romantic fad among the young. Higher salaries and better housing conditions are a more important factor behind this rush. The average age of the scientific personnel at Novosibirsk is actually lower than anywhere in the Soviet Union.

The stampede to the east found its way into a rather truthful Russian novel. Daniil Granin's *Idu Na Grozu (I Go Against the Storm)*, published in 1962, pictures the despair of a group of young Moscow and Leningrad physicists who rushed to sign up for Novosibirsk, only to be rejected because they were needed where they were.

The head of the Science City is the 63-year-old Academician Mikhail A. Lavrentyev, an internationally known mathematician. Currently he is concerned with applied hydrodynamics and explosions and computer work—cybernetics. He moved from Moscow in 1957 at the very inception of the Academy's Siberian division which he was appointed to head.

In cybernetics he is aided by Academician Sergei L. Sobolev. Cybernetics is used by the Russians

as a broader term more widely than it is by Westerners. It covers methods of control and communication common to living organisms and machines, linear programming, information retrieval, servo-mechanisms, and other fields and features related to electronic computing. For the general Soviet newspaper and magazine reader the Science City is identified with cybernetics more than any other subject of research, and with Sobolev more than with Lavrentyev.

Now 55 years old, Sobolev is a passionate mathematician-analyst and a dynamo of energy. A graduate of the University of Leningrad, and formerly a professor in Moscow, he is now one of Russia's outstanding scientists active in Siberia, and his influence extends throughout the nation. He is more than Director of the Institute of Mathematics in Siberia's Science City—it may be said he heads the entire development of numerical analysis in the USSR.

Prof. Sobolev deplores modern Soviet philistinism when it hurts his beloved mathematics, particularly mathematics as serving the computer field. He is, for instance, frankly critical of the "proletarization" of Soviet education, decreed in late 1958 by Khrushchev himself.

This program requires of about 95 percent of Soviet high-school graduates two years of manual labor, or two to three years of military service, before admission to college. The noble and valuable science of mathematics was being damaged by the 1958 reform, Prof. Sobolev declared in a remarkable article, "The Poetry of Mathematics" (*Literaturnaya Gazeta*, December 14, 1961.)

Computer promotion

Cybernetics, to Sobolev, is the unifying agency of the sciences. He speaks of the "mathematization" of all sciences through his batteries of electronic computers. He says that he and his aides at the Institute in Novosibirsk "consider as their foremost task the uncovering, and then promotion of new and yet newer opportunities for the utilization of electronic computers in science and life."

Sobolev has been successful in getting exemptions for his computer students and other talented young mathematicians from the "proletarization" policy. The Siberia-wide contests for gifted teen-agers, organized from the Science City, have been among the steps toward such exemptions. Similar contests are now being tried or proposed in European Russia, too, and not in mathematics alone. The Siberian example has caught on.

Yet another illustrious scholar at the Science City devoted to cyber-

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Dr. Albert Parry was born in Russia and came to the United States in 1921 where he received his Ph.D. from the University of Chicago. He heads the department of Russian Studies at Colgate University and has written many articles on Soviet affairs for *Science Digest* and other publications.

netics is Academician Ilya N. Vekua, rector (president) of Novosibirsk University. Himself a celebrated mathematician, he recently stated that, on his campus, mathematics and physics were being diligently studied not only by mathematicians and physicists, but also by economists, geologists, biologists, and linguists. These Siberian fans of cybernetics further insist that electronic computers should be utilized in anthropology, ethnography, archaeology and numismatics.

Recently, at a session of the Learned Council of the Social Sciences at the Novosibirsk University, a young scholar was defending his thesis for the degree of Candidate of Sciences (slightly above the American degree of master, slightly below our doctorate). To the session came a varied audience of professors and students. Included in the audience were economists, historians, archaeologists, linguists, and a number of outstanding mathematicians headed by Dr. Sobolev himself. This prompted a Soviet journalist to wonder:

"What do the historians and the mathematicians have in common?"

The answer was in the title of the dissertation under discussion: "Certain Problems of Applying Electronic Mathematical Machines in the Science of History." The author of the thesis, Valentin A. Ustinov, wrote it as a result of his participation in a Soviet team of researchers who deciphered certain Mayan inscriptions with the aid of computers (*Science Digest*, Aug. '62). Electronics in this case, it was said, shortened decades of labor to just a few days. At the session Prof. A. P. Okladnikov proudly declared: "We are witnessing an epoch-making fact. We stand at

Sovfoto

1. Ilya N. Vekua, rector of Novosibirsk University, and Sergei Sobolev chat with students on the steps of the University.

2. Internationally known mathematician 63-year-old Mikhail A. Lavrentyev is head of the Siberian division of the Soviet Academy of Sciences, and of the Science City.

DOES AMERICA NEED A SCIENCE CITY?

WHEN AMERICANS heard about the Science City, "our first reaction was one of awe; and the second was a desire to surpass the Soviets in their scientific empire building," says **Industrial Research** magazine.

Actually centers like Cape Canaveral, Huntsville, Oak Ridge, Brookhaven, and many university and industrial research institutes are "science cities." It is the size of the Soviet undertaking that is so staggering. Would such a gigantic center be needed in America?

"On sober reflection," continues **Industrial Research**, "we have concluded that the proposal has enough drawbacks to make it impractical for the United States. A gigantic science city may be just the thing for the Russians, but it is highly questionable on the American scene."

The magazine doubts that America needs such a buildup at this time, and if it were needed **Industrial Research** favors decentralized expansion. "The Russians may be forced to resort to a science city to obtain results, but why can't the U.S. obtain the same—or better—results through the existing system?" The magazine also points out that a science city presents a vulnerable target for enemy missiles and bombers.

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the very beginning of a splendid experiment. How pleasant it is that our country is the one that has done it."

The Science City is already expanding far beyond Novosibirsk. A number of institutes belonging to the main Academy in Moscow, scattered throughout Siberia, are under the jurisdiction of the Siberian division in the Science City. These are the East Siberian, Far Eastern, and Yakutian *filialy*, or branches, of the main Academy.

Now under the administrative wing of the Science City are some two dozen institutes geographically quite distant from it. Among them a few are brand new. This far-flung group includes the Institute of Vulcanology at Kamchatka, the Institute of Frost (Permafrost Study) at Yekutsk, the Institute of Physics and the Institute of Forestry in Krasnoyarsk, and others in Buriatia, Transbaikalia, at Magadan on the Sea of Okhotsk shores, and on the island of Sakhalin.

One or another of these far distant institutes of research may in time be chosen by Khrushchev or his successor to serve as the nucleus of Science City II. Wrote Academician Lavrentyev in *Pravda* in October 1962: "In addition to the further growth of the Novosibirsk science center, two or three other centers of a similar scale should be established elsewhere." And there is a rumor in Moscow that the very next such Science City may be created in eastern Siberia, on the borders of either Mongolia or Manchuria.

by Arthur J. Snider

Why there aren't more woman doctors

WHERE ARE THE GP's?

If you've found it hard to get to see a family doctor in recent years, here's why.

Many general practitioners are leaving the field to specialize. The ranks of general practice have also been hard hit by the reluctance of medical students to enter a GP career. GP's are quitting because they're disenchanted with long hours and night calls; they want to live in the big city; they lack status and many earn enough to go back to school to get specialized training.

Dr. Robert J. Haggerty, head of Harvard's family health program, says that in 1930, 70 percent of doctors were general practitioners. Thirty years later, the ratio dropped to 5 percent.

THE medical manpower problem is, to some extent, "a woman-power problem," says Dr. Alex Steigman, director of the Joint Committee on Pediatric Research Education and Practice. He blames the scarcity of women in medicine partly on high school and college counselors who steer them away from the profession.

There is evidence indicating that many high school students and college undergraduates look toward a medical career but are counseled into other fields on "incorrect and inadequate grounds," he says, adding:

"Why is it that the percentage of woman medical graduates in the United States numbers just under 6 percent while in Canada (virile and outdoorsy) it is 12 percent and in Great Britain (a man's country) it is 24 percent.

"Is there an inverse relationship between the degree to which a society is matriarchal and the emergence of woman physicians?"

It is a mistake to say women are not interested or intelligent enough to go into medicine, contends Dr. Steigman. On the contrary, among

the 1961 National Merit Scholarship program winners, 5.5 percent of the boys and 8.5 percent of the girls gave medicine as their career choice.

Even though medicine as a whole fares badly in woman recruitment, pediatrics as a specialty gets a healthy share of the available supply. Of all woman medics who specialize, 24 percent choose pediatrics, 11 percent choose psychiatry, and 5 percent obstetrics, internal medicine and surgery.

HUNGRY FOR CLAY? WHAT DOES IT MEAN?

A hunger for strange food items may be a tip-off to a nutritional deficiency or a gland disorder, says Dr. Robert E. Stone of Northwestern University medical school.

He describes three patients, one with a hunger for starch, another for clay and the third, a child, for dirt. Each was suffering from the same type of anemia. Another woman with anemia plus a thyroid condition craved paper and rotten wood while a man with an adrenal cortex failure hungered for raw carrots. All lost their odd food cravings when properly treated.

Dr. Stone points out that many animals are able to select specific substances, such as salt or calcium, which may be deficient in their diet, but man does not seem to be able to do so.

HORSE HAIR SHOT INTO BRAIN TO TREAT DANGEROUS MALADY

A missile of horse hair is being fired into the brain with a pneumatic gun to treat a dangerous bulge in an artery. The hair causes the blood in the bulge to clot and turn into scar tissue. The bulge is known as an aneurysm and develops as a result of a weakness in the blood vessel wall. Like a bulge on an inner tube, it is subject to blow-out—with fatal consequences.

An aneurysm is usually treated by placing a silver clip around its neck and isolating it from the blood stream. There also have been attempts to reinforce it with grafts or eliminate it by surgery. All these methods have a certain degree of risk.

Dr. John P. Gallagher, brain surgeon at Georgetown University, Washington, D.C., conceived the idea of injecting a shaft of hair directly into the aneurysm after opening the skull to provide access. The idea was based on the fact that hair is covered with a shingling or scale material that serves as a nucleus for clot formation. Called piloinjection, the technique had been used successfully on 11 patients at the time it was reported in the *Journal of the American Medical Association.*

Dr. Gallagher first tried human head hairs but found they were not stout enough. Neither were eyebrow hairs. Finally he settled on horse hair a quarter-inch long. Hog hair also can be used.

While a single hair is enough to induce clotting, Dr. Gallagher uses four or more injections.

The pneumatic gun is a pencil-like instrument eight inches long and a quarter of an inch in diameter. Power is provided by a tank of compressed air.

RAGWEED NOT ONLY CAUSE OF HAY FEVER

Ragweed is commonly believed to be the only agent responsible for hay fever but in 33 years of practice, Dr. Herbert J. Rinkel of Kansas City, Mo., says he has found only three patients who were allergic to ragweed alone. The overwhelming number of hay fever sufferers are sensitive to various other Fall pollinating plants or to molds and foods, as well, he points out in the *Archives of Otolaryngology*.

Five or six pollen groups reach their peak at the height of the ragweed season. The late Fall season also is marked by a change in dust sensitivity. Houses frequently are closed and furnaces started. Many allergic persons are more sensitive when temperatures drop.

HIGH PRESSURE CHAMBER TO SAVE BLUE BABIES

An operating room has been built within a boiler-like compression tank to permit surgery at Children's Hospital, Boston, on four "blue babies" too critically ill to be handled in conventional ways. The so-called hyperbaric pressure chamber raises the air pressure to three times the normal atmospheric pressure and thereby forces more oxygen into the blood stream. In the case of the four blue babies, too little oxygen was received through the body because of a heart defect. It was necessary to bring the oxygen level up to a point where delicate heart surgery could be performed. The infants were placed under a pressure equivalent to that experienced 100 feet under water. Their oxygen saturation was increased to 80 percent of the normal level.

Dr. Robert E. Gross, surgeon-in-chief at the hospital, estimates there are 8,000 babies born in the United States each year with heart defects causing oxygen starvation so severe they are beyond surgery.

The hyperbaric operating chamber was devised by Dr. Iete Boerema of the University of Amsterdam's Wilhelmina Clinic to treat victims of gas gangrene, carbon monoxide and other conditions in which a saturation of oxygen in the blood stream was deemed desirable.

Many models are being used throughout the United States and abroad for other conditions, including coronary heart attacks.

Before a patient is removed or a physician leaves the chamber, he must go through a decompression cycle similar to that used by divers in order to avoid the "bends."

THALIDOMIDE HEROINE SEEKS NEW CULPRITS

Dr. Frances Oldham Kelsey, who kept the deforming drug thalidomide off the American market says that no drug taken within the first three months of pregnancy, can be ruled out as a possible cause of birth defects.

She says several drugs other than thalidomide are under investigation by the Food and Drug Administration because of an association between their intake and a subsequent birth of a deformed baby. She emphasizes, however, the association may be only a coincidence.

For her role in the thalidomide case Dr. Kelsey has been appointed chief of the investigational drug branch of the Food and Drug Administration.

Among the classes of drugs under investigation are those commonly given for weight reduction, particularly the diuretics, which remove excess fluids from the body. While diuretics are ordinarily given during the later stages of pregnancy, it is possible a woman might take them unwittingly in the first three months when embryo formation is critical.

Other drugs being studied are those given for morning sickness, or nausea of pregnancy. Dr. Kelsey said the College of General Practitioners in Great Britain reported 29 cases in which birth deformities were associated with the use of anti-vomiting drugs during pregnancy.

Some pregnant women in Britain have been known to take anti-histamines for nausea of pregnancy, Dr. Kelsey said.

Tranquilizers also have been associated with deformities, as have nasal decongestants commonly used for relief of common cold symptoms.

PATIENTS SERVE AS OWN BLOOD DONORS

Dangerous reactions to blood transfusions can be eliminated by use of the patient's own blood taken from him in advance and refrigerated until needed at the time of surgery.

Three doctors at Augustana Hospital and the State Tuberculosis Hospital in Chicago tested the idea on 53 patients who were scheduled to undergo operations. The last unit of blood was taken four or five days before the operation.

A total of 78 units was drawn from 53 patients, 44 men and 9 women, who ranged in age from 20

to 74 years. All underwent chest surgery of some type. Each received at least one unit of his own blood. One patient received five.

The doctors, George Milles, Hiram Langston and William Dalessandro, said there was no hazard, even in the older patients. They recommend the technique—autogenous transfusion—on the basis of convenience, availability of the blood, safety and economy.

Two New York doctors are recommending that blood be warmed to body temperature before being administered to patients. C. Paul Boyan and William S. Howland have found it reduces the incidence of heart stoppage. In addition, the patients regain consciousness faster after an operation.

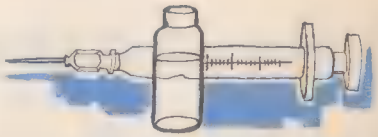
HORMONE GIVES GIRLS BOOST IN HEIGHT

Two undersized girls added to their height when given a growth hormone at the University of Wisconsin Medical School. The growth gain is about three-fourths of an inch in two months. At this rate, says Dr. David W. Smith of the pedriatics department, several inches may be added the first year. But it's likely the rate will slow down.

One of the girls is 16 and has the height of a 10-year-old. Dr. Smith hopes that with treatment she will grow to at least five feet tall.

The second girl is 11 and has the height of a five-year old.

The limitation in the treatment is the availability of the growth hormone. The present supply was obtained by extraction from human pituitary glands removed during autopsy examination.



Though most of the hormones needed by human beings can be extracted from animal glands or simulated in the laboratory, growth hormone for human use can be obtained only from the human pituitary, a pea-sized master gland located at the base of the brain. While lower animals will respond to the growth hormones of higher animals, the reverse is not true.

Pathologists in Wisconsin have been cooperating by sending in pituitary glands from autopsy material.

"While a completely normal stature could theoretically result," comments Dr. Arlan L. Rosenbloom, "there is evidence that the growth response diminishes with continued treatment. We will continue the growth hormone treatment as long as an adequate response continues, but since much remains to be learned, we cannot say how long this will be."

The pediatricians emphasize that the pituitary growth hormone is helpful only to the child who is lacking growth hormone, a rare cause of shortness of stature.

The rush for automation in schools is on. When did this trend begin, and where will it end? An expert gives his views. . . .

TOMORROW: AUTOMATED SCHOOLS

by Dr. R. E. Packer

WHEN today's kindergarten student graduates from high school in June, 1975, will he insert his final report card into the slot of a Diploma Dispenser and hear a recorded "Congratulations" as his certificate of graduation pops out? Probably not. But both his final report card and many of the grades on it will undoubtedly have been produced by putting automation to work at dozens of classroom assignments.

Automating our nation's schools is much, much closer than we realize. Technology is touching our education industry now just as it has touched in turn every major industry of modern society as necessity has dictated.

The "necessity" of relieving our over-crowded schools and helping our harassed teachers to impart the flood of science-swollen knowledge already has "mothered the invention" of a wide assortment of revolutionary educational aids: language labs, classroom TV, animated displays, training simulators, programmed textbooks, teaching machines and finally educationally programmed digital computers.

In the current school year over 10,000 students in New York State alone are learning French using electronic language labs. The scholastic records of 15,000 pupils in northern Westchester County's schools are being processed by automatic tabulating equipment. And the 54 payrolls for a Los Angeles educational staff of some 46,000

teachers and administrators will shortly be handled by a single large automated data processor.

Each of these giant strides toward educational automation is being imitated in a hundred exploratory baby steps by small school systems everywhere.

A week's work saved

At Collingswood, New Jersey, for example, the high school has accepted a new service by nearby RCA through which a special computer program prints out student grade lists and updates classroom scheduling for the new semester within three hours—a previously weeks-long task for the school staff.

In tiny Buckeye, Arizona, youngsters are beginning to read with electronic reading labs. And Superior, Arizona, has just purchased for its high school an overhead projector for visual aids ($450) and five mechanical teaching machines ($35 each) for sophomore English. "Student progress in learning with the machines," says the local superintendent, "will be judged on experimental conditions here. If conclusions warrant it, we will expand the use of the machines."

The initial wave of professional resentment at having teaching machines or "TV Master-Teachers" intrude upon the classroom is subsiding. There is now a growing eagerness to make use of the news tools now available.

Labor-saving aids are not new to the American schoolteacher. Teacher guidebooks of prepared lesson material help her plan daily classwork. Student workbooks with fill-in problem material make assignment of homework and grading easier. And the old familiar textbook-with-the-answer-in-the-back is the simple forerunner of current "programmed learning" texts. Automation may indeed have sneaked into school with the first tardy bell rung by an automatic schoolbell clock control—some two generations ago.

Beginning in the '40s

The first major indication of a trend toward automation of public education was in the formation in the late '40s of Audio-Visual Departments in most large school systems, following the successful training of millions of servicemen by films during World War II. With the growth of television came educational stations. The first educational TV station was allocated in 1953. A National Educational TV Network (NET) was organized during the past ten years, and now has about 60 affiliates.

In the late '50s, publicized results of Harvard psychology experiments in mechanically controlled, or "pro-

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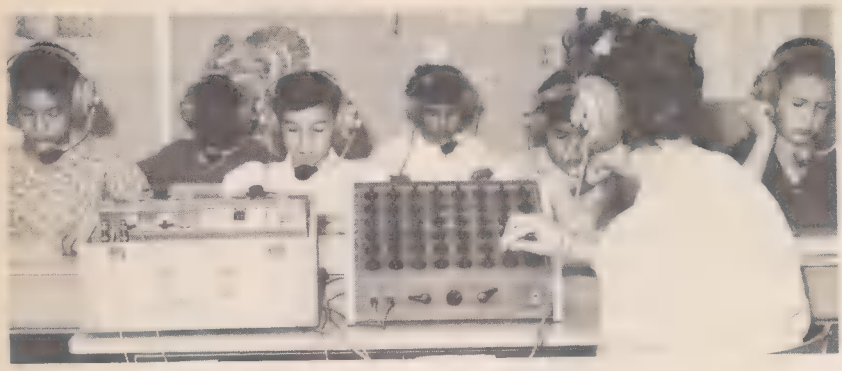
Dr. R. E. Packer is on the consulting staff of the RW Division of Thompson Ramo-Wooldridge, Inc. His research fields have been automated education and the human factors in electronic data processing systems. Educated at Yale and the University of Minnesota, he has had articles and short stories published.



Electronic teaching equipment allows a teacher to give individual attention to each member of her reading class without interrupting the work of others.

grammed" individual instruction techniques set off a rush into research on automation of the learning process.

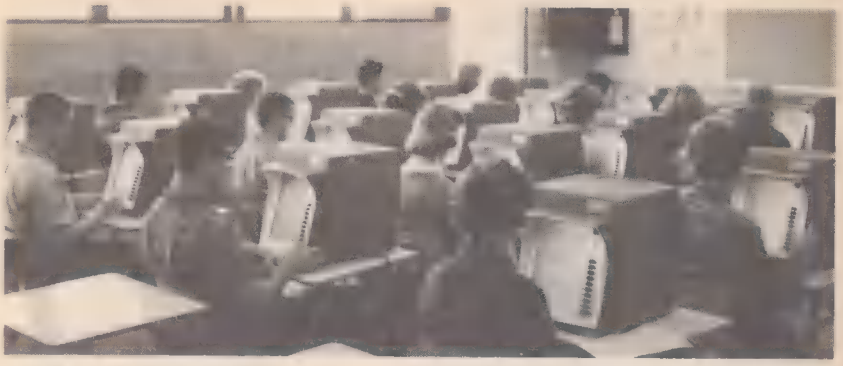
This final development with its talk of "teaching machines," "language labs," "learning centers," and such, brought into the open the fact that mass education is now entering the automation era. The 1958 National Defense Education Act made a lot of money available for modern educational equipment and for experiments with the new teaching concepts. The U. S. Office of Education gave out $6,000,000 in its 1962 fiscal year for educational research; and federal aid for purchase of educational devices will be stepped up sharply, particularly for automated technical training to keep future unskilled high school graduates from being displaced.

Today over 200 companies, including nearly every major educational book publisher, is involved in the research, development and marketing of a mountain of new automated education products.

City and state governments have begun to help too, particularly in such areas as driver training for high-schoolers. The simulator machine that brings the "feel" of an automobile and the "look" of the highway to a beginner at his driving desk has probably become the most widely-used teaching machine to date. Mobile classrooms—special house trailers—move sets of "Drivotrainers" from school to school in the Los Angeles area, teaching teenagers good driving habits.

Foundations provide millions

Besides government and industry money, the huge resources of the non-profit foundations are pouring into the field. The Ford Foundation alone is supporting projects totalling tens of millions of dollars annually. Ford has been the chief backer of educational TV, donating



U. S. Industries

A long way from the little red schoolhouse, some of today's schools provide students with desk-size teaching machines. Shown here is the Autotutor.

videotape recorders to each educational station, sponsoring Continental Classroom on NBC and innumerable educational center series.

Machines encourage students

In many places the classroom is being guided by written "programs" of small steps, or items, in a school subject presented in a new-styled text or workbook, or by a compactly designed mechanical or electrical presentation device. Various devices may not only accept the pupil's answer as right or wrong, but may clarify, on a display screen, confusions shown by the answer, encourage the student to learn faster or slower according to the difficulty he is having with what it tells him, and even "keep score" on a tape so the teacher can see where his rough spots are and help him, individually, over them.

Many of these devices now have several semesters of classroom "experience" behind them. Encyclopedia Britannica Films has conducted a large-scale instruction project in several high school courses in Roanoke, Virginia, using film strips and programmed texts. Hughes' Videosonics Systems, small programmed audio-visual tape-slide projectors, have taught science in Los Angeles at the elementary level. In Yorktown, New York's IBM Research Center, high schoolers are machine-learning German, stenotyping and statistics, guided by an IBM 650 digital computer.

IBM's experimental use of an electronic computer to control the program for each pupil's learning device is an example of the probable future form of automation in the school. Over two years ago, nonprofit System Development Corporation established a laboratory project, CLASS, in which a large (Philco 2000) computer was used to study the range of educational tasks it could perform in a school of the

future: Individual and group instruction, attendance keeping, report card compiling, class scheduling, school payroll, administrative budgeting, library reference retrieval and so on.

Already computers are in daily educational action. The Educational Testing Service at Princeton, New Jersey, is using an RCA 501 for electronic scoring. It grades 6,000 test papers per hour, stores student records in its 10-million character memory, and prints out results at 10 lines per second. A sign of the future is the RCA 301 that will soon be handling school registration and programming at the state level in the California State Education Building at Sacramento. This data processor may even forecast educational trends and evaluate administrative policies for the State Department of Education.

Learning to live with them

Eventually authoritative consulting aid will be needed by each local school system as it steps into the maze of automated educational theories and hardware. Both educators and administrators must understand fully the technology at their disposal. Teachers will have to be taught to control rather than to cringe before the new devices, and students must accept the idea of learning with the aid of machines that may be more integral to their lives than the automobile is to our lives.

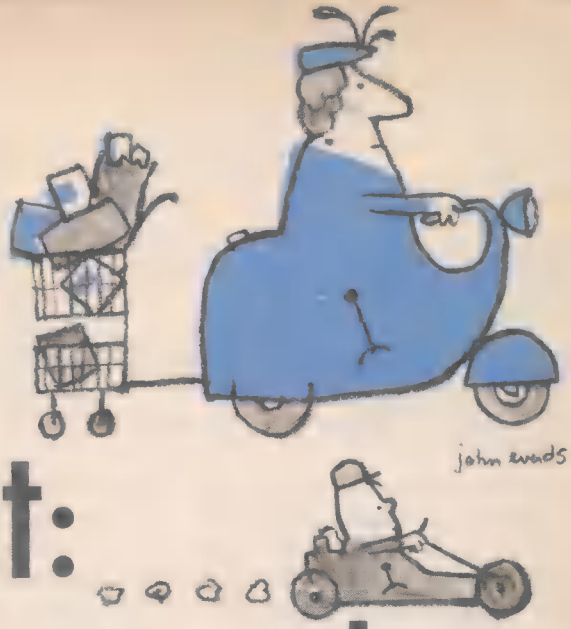
Experimental instruction, early in high school, in the programming, operation and maintenance of computers began in 1960. This skill, it was noted, is best taught to the young. Over 300 high schoolers a year are now completing computer courses at the University of Oklahoma and 300 more at Bethesda, Maryland.

Automated mass society

Why are we suddenly bringing machines into our public schools at all age levels? The answer is if a child is to grow, in easy familiarity with automated machines, into a man confidently superior to them in an automated mass society, he must receive both early technical training and a broad higher education. These can be provided to everyone only by teaching about the new machines, and also with them.

In other words, an education will be a truly basic requirement in our children's time.

How far can automation go in schools? This past fall, each of the 2,480 students seated in Arizona State University's card section displayed a complex program of cards in their correct colors and sequence smoothly—and without any pregame rehearsal. Their coach? A GE-225 computer, whose specific instructions to each stunt-card holder were printed out on 2,480 separate data output cards stapled to each stunt-card set. The education provided by automation may turn out to be even broader than we have yet dreamed.

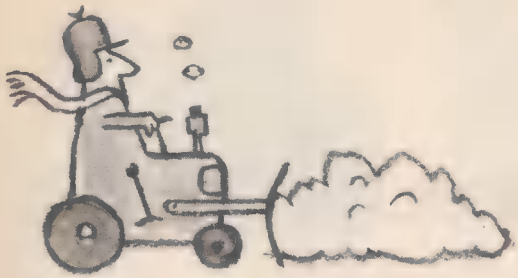


Next: automated people

By Robert Thomas Allen

THOSE cricket-legged Martians of science-fiction don't look any funnier to me than the visions I have sometimes of the way we worldlings are soon going to look if we don't start walking again. We cut our lawns sitting down, and ride around golf courses; we make bank deposits, buy hamburgers, see movies, and attend drive-in church services without moving our feet farther than from the gas pedal to the power brakes. So many youngsters pass my house on motor scooters that they already are beginning to look like little moon workers answering one of those general alarms: "Attention! Earth men entering valve 36! Go get them!"

Kids don't even move when they hitchhike now. They don't even



move their thumbs now. When I was a kid, if we hitchhiked, we ran backward, waggled our thumbs, and tried different techniques, from looking cheerfully into the driver's eyes and practicing The Power of Positive Thinking, to trying to look undernourished and neglected by our parents. But we'd been for a walk first: a day-long hike up some valley or along some dusty maple-bordered country road.

Thousands of kids in today's sprawling suburbs don't even have to walk to school any more. They ride school busses. As soon as they reach the age when they're chasing women, about 14, they get cars. We used to take our girls for a walk. Any girl today who had a boy call on her and ask, "Do you want to go for a walk?" would figure she had gotten stuck with a failure.

When I was a kid, walking was not only the accepted way to move from place to place, but a sign of health, sound values and vitality. Driving a few blocks to shop was an indication of decadence. My father walked farther around our kitchen than most people walk today in a week just imitating some of the first-car owners on our street.

"I saw them prying Mr. Clifford away from the wheel of his car out there," he'd say, walking around with his elbows bent and legs bowed to simulate his idea of someone who had "seized up" in the position of driving.

My father was an inveterate walker and walked downtown to work and back again every day of his life. Motorists could never understand why he walked when he could ride. They still can't, although they're a different set of motorists. At 85 he's still working on an independent piecework basis, and when he delivers orders he still walks home, beating the stalled buses and autos, and wondering when the world is going to start to progress.

A lot of men on our street walked to work and back. By just walking downtown and back every day you saved 10 cents a day carfare, which mounted up. And people took strolls in the evening, something that has gone the way of whist. The only place I see people strolling now in the evening is at summer resorts,

and they're all strolling away from the noise of power boats down on the lake.

People used to categorize one another according to how they rated as walkers. "He's a great walker," or, "He's a fast walker," or, in the case of people like my grandfather, "He's not much of a walker." My grandfather was almost always sound asleep on the sofa under the Sunday papers, but he often used to boom heartily, "A wonderful day for a walk!" just before he lay down. He at least thought walking was a good idea.

We don't even think it's a good *idea* any more. I see we'll soon be able to shop while standing still on moving sidewalks. When the school my kids go to organizes an outing, the first thing it does is to appoint a committee to arrange for cars. The Pied Piper wouldn't stand a chance today of stealing our kids if they had to follow him on foot.

But perhaps this is all a temporary condition. I'm happy to see that many cities are experimenting with the mall idea, where people are encouraged to walk, although in Miami, Florida, I notice, they've provided the "walkers" on one mall with little electric cars!

Perhaps the most heartening sign took place recently in the town where I live, where the bank has been building more and more drive-in windows. I noticed the other day that they've added a brand-new feature, a special teller's cage marked "Walk-Up Window" which they evidently regard as some sort of novelty. I like to think it's the first faint indication of a reverse trend. The world was probably no better a place before we all took to wheels, but it at least seemed less complicated and disturbing after we'd been for a walk.

HOW TO SHOOT DOWN HAIL

PIX

Monks at an African mission protect crops from hail by ringing church bells. Some farmers are using more modern weapons—rockets.

by Piet van den Berg

FARMERS in Swaziland, South Africa, have declared war on hail. In their fight they make use of the most modern weapons—supersonic rockets equipped with explosives. At the first signs of a storm, rocket stations are manned and launchers pointed in the direction of the oncoming clouds. As soon as the first hailstone falls, a salvo of rockets is fired, and, after about half a minute, the hail is incapable of damaging crops.

There is no actual scientific proof that the rockets destroy the hail but farmers who have used them don't doubt their effectiveness. Where the rockets have been used, the hail was either turned into rain or came down "mushy," that is, the structure of the hailstones had become so

Condensed from *Farmer's Weekly*, Bloemfontein, South Africa.

fragile that on landing on the ground they disintegrated in a splash, doing no damage to crops.

Of the theories advanced to explain how hail can be made mushy, the cavitation theory is the most likely. Cavitation occurs when a sound wave from an explosion passes through a liquid and produces a great many small bubbles or cavities. If the liquid is then frozen such bubbles can collapse with violence. In the case of hail, the ice becomes fragile.

This, coupled with the fact that there is always a certain amount of natural internal melting taking place in hailstones, thus creating cavities containing liquid water inside the hailstone (sometimes called "flowers of ice"), may explain why an explosion in the air can lead to hailstones shattering when they strike the ground.

The effect of mission bells

Anti-hail rockets were first brought to Swaziland by G. K. Bordihn, leading farmer and president of the Swaziland Agricultural Union.

Before he came to Swaziland, Bordihn had a farm next to a mission. Hail had never been known to occur on that farm and this was attributed by the local farmers to the praying of the monks at the mission.

Bordihn noticed that whenever a hailstorm approached, the monks would start ringing the heavy church bells. Bordihn says one day he saw a storm approaching along the side of a mountain range and as soon as the bells started ringing, the hail stopped. During the 34 years he was on that farm, he only had hail once and this was when the monks failed to ring the bells.

This experience convinced him that there had to be "something" in the anti-hail rockets used in France, Italy and Austria and reportedly in the Soviet Union. He imported some French anti-hail rockets in 1959. Last year, when a titanic hailstorm struck the area of his farm, Bordihn was able to protect his crops, spread over an area of a square mile, by firing rockets into the hailbearing clouds. His neighbors, who were not equipped with rockets, suffered tremendous damage.

Now nearly all the farmers in the area, including the Swaziland Government Experimental Station, have equipped themselves with rockets.

Bordihn says the rockets are by far the cheapest way of protecting crops against hail damage—much cheaper than hail damage insurance.

Shortly after Bordihn introduced rockets to Swaziland for the first time, Ronnie Black, another Swaziland farmer, thoroughly investigated anti-hail rockets used in other countries.

At Verona, Italy, he was most impressed with the way the Italian Government helps farmers to combat hail. There, a special meteorological radar station is manned 24 hours a day and is in direct radio contact with central district control stations. These, in turn, are in di-

rect communication with the actual rocket firing stations spread in strategic positions over the entire north of Italy. This area is known for its excellent apples, peaches, cherries, grapes, wheat and rice crops.

The Italians have been operating rockets since 1948. They started using imported French rockets, but found that these were deflected by high winds and did not reach high enough altitudes. The Italians then developed two of their own types of rockets: One to reach 6,500 feet and one for 4,500 feet (the French rockets only go up to 3,000 feet).

The rockets travel at 1,000 feet a second and, therefore, take six and a half seconds to reach 6,500 feet where the load of two pounds of T.N.T. explodes. The explosion apparently disintegrates hailstones over a circular area of 530 yards diameter. The Italian rockets are also equipped with tailfins, so that they are not as easily affected by winds. Because of the tailfins, these rockets can be fired at an angle of up to 45 degrees, making it possible to shoot them into clouds before they have actually reached the area to be protected.

Rockets are equipped with a self-destruction device which completely distintegrates them to avoid starting fires or damaging property, livestock or personnel. On the average 50,000 rockets are fired in Italy each year, and the Italian Government pays one-third of the cost.

The Italian 4,500-feet rocket is 3 feet long and the 6,500-feet rocket

Farmer's Weekly

Swaziland farmer G. K. Bordihn shows how the explosive head of an anti-hail rocket fits onto the propellent section.

is 3 feet 3 inches long. The main components are: the explosive head, the propelling body, the firing device and the self-destruction device. The explosive head consists of a cardboard casing which fits into the propellent section. The casing is protected from moisture by a tin foil covering. The casing is filled with about two pounds of T.N.T. in a plastic bag.

The propellent section consists of a tube filled under pressure with propellent. The base of the rocket is fitted with four plastic stabilizing fins. The detonator is situated at the base of the rocket and is connected via a delay fuse to the propellent.

The launching device consists of a base ring and stand made of light steel. Attached to the stand are steel runners which act as guiding rails to hold the rocket in position. The rocket can be fired manually, electrically or by a combination of electricity and radio impulses.

Should a farmer decide to equip himself with anti-hail rockets to protect his crops, his farm should be carefully assessed as to the direction from which the hailstorms normally approach. The type of storms usually encountered should also be considered. If semi-horizontal or driving hail is usually encountered the launching stands should be tilted to a maximum of 45 degrees into the direction from which the storms normally approach.

The launching sites should be erected to form overlapping circles, each circle having a diameter of 530 yards. This is the area effectively covered by one rocket. Called a grid system, research in Italy has shown that it is the only way satisfactory results can be obtained.

Hit the dirt

The launching sites nearest the edge of the known approach of storms should be equipped with two launching ramps to promote rapid firing and reloading. A certain distance between the storage magazine and the launching sites has to be kept for safety reasons. A small dugout to protect personnel should be built close to each launching site. Protective head-gear (pith helmets) should also be worn.

One of the main problems for the farmer is getting enough warning of impending bad weather conditions. Weather instruments are available, and by learning to read these correctly, and by taking advantage of the Weather Bureau's forecasting, coupled with local knowledge, a reasonable forecast of change of weather can be made, but only radar equipment can forecast hailstorms.

Of the 15 to 20 storms for which a farmer has to stand by during a season, possibly four will be major storms. Of these, only one or two may have hail. These storms, depending on the district, tend to occur during a certain time of the day. The farmer must, therefore, be prepared to stand by to protect his crops on every occasion that the chance of a storm is prevalent, though in the majority of cases it may not be necessary to fire rockets.

As the first hail begins to fall the rockets should be fired; the number used will depend on the severity of the storm. The initial result will be a lull in the hail conditions, and mushy hail may fall. This must not be taken as a sign of complete success. The hail can return and further firing may be necessary. As soon as the first salvo of rockets has been fired, the launchers should be reloaded and kept ready.

Although more than 1,000,000 rockets have been fired in Italy and no serious accidents have occurred, it must be remembered that the rockets are dangerous and have caused fatal accidents in other countries. The farmer going in for hail protection, therefore, should spend a lot of time getting acquainted with the rockets and their firing and also thoroughly train his staff.

First it was IGY now it's IQSY

By Bruce H. Frisch

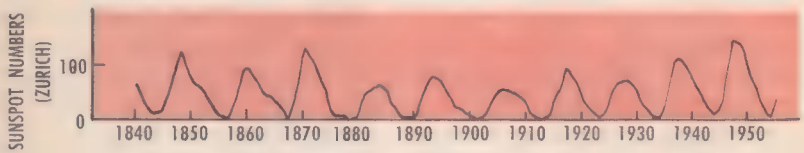
With the energy of a billion H-bombs, a sun flare flicked its bright tail a million miles into space. Eight and one-half minutes later, short-wave radios on earth fell silent, very long-wave radios boomed louder, and FM and TV speakers crackled. In less than an hour, a hail of cosmic rays, particles that can have more than ten million times the energy delivered by the biggest atom smashers, punched through the atmosphere. Twenty to 40 hours later, compass needles quivered, teletypes printed nonsense words, and auroras lit the sky.

Ever since Galileo began examining sun-spots through his telescope in 1610, men have blamed them for cycles in everything from wars to stock prices. Today, we know that interactions between sun and earth occur all the time with a steady solar wind of charged particles streaming by the earth.

Sun-spots erupt in eleven-year cycles. During the 1957-58 peak, world scientists cooperated in an International Geophysical Year to study sun-earth relations. Minimum activity is due in 1964-65. In March, scientists from more than fifty countries met in Rome to plan the International Years of the Quiet Sun, or IQSY. Data on how the sun's electromagnetic radiation, charged particles and magnetic field affect the earth will be compared with data from IGY.

Scientists will concentrate on the upper atmosphere and space. Here new scientific tools have learned more in the last five years than was known from all previous research. This region has taken on new importance with the possibility of space travel. A sudden flare can cut communications with an astronaut and bombard him with dangerous radiation. The sun also probably supplies energy to lethally fast particles in the Van Allen belts, and may indirectly furnish the particles themselves.

Considering the many ways the sun affects the atmosphere, IQSY observers will closely watch one phenomenon: the weather.



Sunspots follow an 11-year cycle, with periods of pronounced activity every 90 years. Trees grow faster when there are more sunspots; most other correlations are unproved.

LOST CIVILIZATION

A colossal monument built by an all-but-forgotten king is today being uncovered on the sun-baked mountains of Turkey.

THE mists of 20 centuries of history had almost completely obscured the name of Antiochus I, king of Commagene. But in recent years an expedition into the Anti-Taurus mountains of Turkey, led by an American woman archaeologist, Theresa Goell, has been excavating the fantastic mausoleum that this god-king had built for himself. The size of the monument, and the extraordinary beauty of its craftsmanship has led historians to revise their idea that Antiochus was the unimportant king of a semi-barbarian country.

Commagene, on the Euphrates River, became an independent kingdom after the empire of Alexander the Great dissolved. Although the land is now barren and hostile, it was once very fertile. The kingdom added to its wealth by using its command of river crossings and vital trade routes to collect tolls. Com-

PIP Photos by Ara Guler

Surveying his kingdom 2000 years after its destruction, Antiochus I shows a marked resemblance to the conventional portraits of Alexander the Great from whom he traced descent on his mother's side.

magene was finally absorbed into the Roman empire in 72 A.D.

Antiochus, who was deified in his lifetime, claimed descent from Alexander on his mother's side and from the kings of Persia through his father. He died about 31 B.C.

Persian and Greek civilization and culture merged in this tiny kingdom and created a rich and colorful art, architecture and religion. Antiochus built his mausoleum on Nemrud Dagh, the highest mountain in the area of Samosat, his capital. When it was first built, the monument was adorned with two identical sets of five 29-foot-high seated statues. The gods represented showed the fusing of Greek and Persian cultures. There were the sun god, a combination Apollo-Mithra-Helios-Hermes; Fortune, or the Fertility Goddess of Commagene; "Father of Gods" Zeus-Ahuramazda; Antiochus himself; and the hero god Herakles-Artagnes-Ares. Earthquake and erosion have decapitated most of these statues. The heads, now cleared of debris and set upright by the archaeologists, are the most impressive sight in the ruins at Nemrud Dagh.

1. The gods of Commagene look out over Turkey's Anti-Taurus mountains from the west terrace at Nemrud Dagh.

2. A sandstone lion from the west terrace.

3. To give an idea of the size of the heads the photographer stands between the heads of Antiochus and Zeus-Ahuramazda.

4. Although the heads are those of the Greek gods, Herakles (left) and Zeus both wear Persian headdresses signifying their fusion with similar Persian gods.

2

3

4

Four months without water

A small Indian desert rodent can live four months without drinking water. Biologists under P. K. Ghosh at the Jodphur (India) Central Arid Zone Research Institute captured several gerbils and fed them a dry diet. Their investigations showed that one of the gerbil's secrets of survival was tough kidneys, which can remove salts and nitrogenous wastes at high concentration, thus conserving body water. The blood becomes thicker also, but continues to do its job.

While on the dry diet the animals actually grew fatter, indicating that they perhaps build a reserve of water in the form of fat.

The human animal needs more water in the desert than a normal thirst makes him drink. He loses more water through perspiration than he replaces by drinking, and he then becomes dehydrated and weak.

Dr. E. Sohar of an Israeli climatic research unit wondered if this were so even under ideal conditions. He got nineteen men to march 370 miles in 24 days under the August sun. They were accompanied by a mobile canteen stocked with beverages ranging from milk to beer. The marchers could take as much time as they wanted to drink as much as they wanted.

Milk gave the men diarrhea in the heat. Carbonated drinks filled them before they had had enough. Beer got them drunk first. But the men liked cold, sweet, fruit-flavored drinks so well they drank enough to keep from dehydrating.

UNBORN BABIES MAY SHOW HOW DRUGS DEFORM

A Canadian medical researcher has suggested that drugs causing birth defects in laboratory animals be tested on humans. Professor F. C. Fraser of McGill University thinks women who are going to have abortions for therapeutic or health reasons should be asked to take suspected drugs. Examination of the removed fetus would show if the drugs are also teratogenic—mon-

ster-producing—in human beings.

His recent discovery that salicylates and aspirin are teratogenic in mice prompted the suggestion. This does not mean aspirin or many other drugs that produce deformities in animals are dangerous for humans. Drugs that harm one species do not always harm another. It is this fact that makes it difficult to predict the effects on humans and leads Professor Fraser to call for direct tests.

Many other drugs safely taken by humans produce defects in rats. These include antibiotics such as penicillin, some tranquilizers and related drugs for mental illness, drugs for diabetics and others.

Professor Fraser also suggests a law requiring physicians to report on the first 10,000 or 100,000 persons to take a new drug. Children of mothers who take the drug would be carefully examined.

CULTURE BY COMPUTER: MARGARET MEAD'S IDEAS

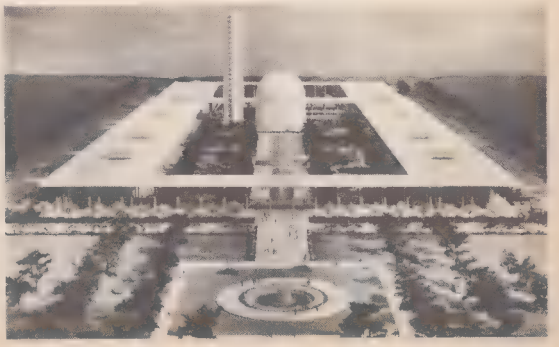
Computers can help plan cultural change in backward nations, a world famous ethnologist has suggested. Industrialization in many nations is planned; cultural change, however, is not. One consequence may be early disappointment with new ways and retreat back to old traditions.

Ethnologist Dr. Margaret Mead wants social planning but recognizes how complex societies are. Computers and other modern technological tools can help do the job in various ways, she told delegates to the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas.

A computer could uncover groups who have had the happiest experiences with change, and who could lead others toward industrialization with optimism and hope.

Analysis might also show the best order for introducing changes like migration, new farm machinery and a written language. Each country is likely to have a different best order. In a country made up of several different peoples, each group may need a different schedule.

Among other problems for com-



Pakistan will build a $5 million Institute of Nuclear Science and Technology by 1965. Model gives preview of facilities for research and training in nuclear physics, medicine, agriculture and for a planned atomic power program.

puter analysis is finding people who can learn new skills demanded in an industrializing country. Some must be fashioned into an elite fully sophisticated in the new social, political and economic order.

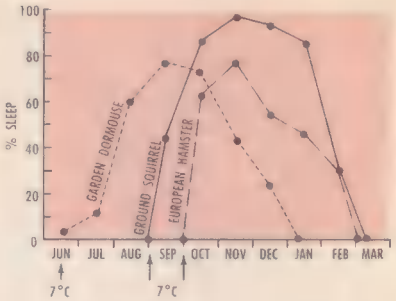
HIBERNATING ANIMALS: HOW THEY SURVIVED WINTER

Do you think you were the only one to have a tough winter?

The body temperature of a hibernating mammal drops as low as 39°F to 41°F, but its nervous system stays fully awake to serve as a temperature regulator. Few warm-blooded animals hibernate. Those who do are thought to be originally from the tropics. Animals like the woodchuck and ground squirrel couldn't stay active and survive a cold winter, so adapted by hibernating. In this state they use only a fraction of their normal energy.

Professor Charles Kayser of the University of Strasbourg, France, says that hibernators do not sleep straight through the winter but must wake at periods ranging from two days to three weeks and work off accumulated poisons. Waking periods last only ten percent of the time but account for 90 percent of the energy burned.

In an article in *New Scientist* Professor Kayser pointed to a cycle in the activity of the endocrine glands as the cause of hibernation. The hormones these glands pour into the blood regulate body chemistry. The glands in turn are regulated by hormones from the anterior pituitary gland. As autumn passes, the glands slow down until eventually body temperature falls and sleep begins. If the hibernator receives injections of missing hormones, it cannot hibernate.



Hibernating animals go into long sleep if placed in refrigerator at 7°C (45°F) even in summer, but only for a normal period.

Common dormice, garden dormice, and European or golden hamsters will pass through the whole cycle in the middle of the summer when put in a refrigerator.

Once the body temperature of a nonhibernator drops it will die, because its nervous system will not keep functioning. The secret of how the nervous system of a hibernating animal keeps working is probably in the individual nerve cells, Dr. Kayser thinks, and will be buried there for a long time to come.

PLANS MOVE AHEAD FOR OLE' INTERNATIONAL TECH

An International Institute of Science and Technology has now passed the study stage. Recently a committee appointed by the North Atlantic Council reported it was in

favor of the idea and sketched the following outline.

The Institute would be sponsored by, and draw its 1400-member staff from, many western nations. One thousand graduate students would attend five interdisciplinary centers, where the emphasis would be on breaking down barriers between branches of science and between science and the humanities.

In its combined educational and research role the Institute would also try to link pure and applied research more closely. A special effort would be made to put the results of basic research to use quickly in industry.

At the same time it would try to improve the grounding in basic science of engineers in the West by encouraging graduate work.

An institute for advanced study within the larger Institute would hopefully draw scholars who could take part in an international exchange of ideas.

International Science and Technology reports strong support from technical communities on the continent and in the United States, but less enthusiasm in Britain. Overall, a member of the President's science advisory staff says chances for the Institute are good. The outcome depends less on science, he feels, than on politics.

HUNGARIANS QUESTION ORGANS' BIOCHEMICAL CHARACTERISTICS

The University of Pócs, a Hungarian city founded in Roman times, dates back to the 14th century. Recently two zoologists there, G. Székely and J. Zsenágothai, have been studying the responses of extra legs and wings grafted to the bodies of young chickens during their embryonic development. The results of the Hungarians' experiments have led them to challenge the idea that particular organs create specific biochemical characteristics in their nerve fibers and that these in turn insure correct connections in the brain.

The additional legs and wings developed by the chicks did not have muscles, but their skin and feathers were normal. Supplied by nerves from parts of the spinal cord which never go into a limb, they were sensitive to the touch.

When the grafted limbs were touched, a simple reflex action was produced in the normal limbs. For example, when a grafted limb was stimulated, bending occurred in the normal leg on the same side of the body. If the graft was near the wing, stretching occurred. In some instances, strong stimulation caused the chicks to walk or clean the foot on the side touched. Both types of behavior took some time to develop. Although the responses appropriately referred to a limb, they did not always refer to the right type of limb. Stimulation, of a grafted leg, for example, could cause the movement of a wing and vice versa. The more complex behavior of limping and cleaning occurred only when the graft was supplied by several spinal nerves.

How we're

Bat

Skunk

Raccoon

Fox

You can get rabies from any of these animals

fighting illness from animals

Science is mounting an attack on rabies, bubonic plague, and more than 100 other diseases that man can get from infected wild animals

by Jerry E. Bishop

A LITTER of baby raccoons, tested after having bitten five children in Indiana, is found to be rife with rabies. A bat loose in the basement of an Iowa home is discovered to be dying of rabies. Ohio health authorities, during a routine check of wild animals, detect 209 rabid skunks in a three-month period.

These and similar reports flow month after month into the Federal Government's big Communicable Disease Center (CDC) in Atlanta, reflecting what appears to be an alarming spread of rabies among the nation's wildlife. Although human life has not yet been seriously endangered—only two human deaths from rabies were reported in the U.S. last year, the lowest number on record—Federal researchers are worried nonetheless. With more Americans taking up camping, hiking and other outdoor recreational pursuits, the chances of a person being bitten by a rabid wild animal are definitely increasing, health officials explain.

This threat of rabies focuses attention on a class of diseases which poses one of the most stubborn problems in public health—zoonoses (zo-ON-o-sees) diseases of animals which are transmissible to man, and in some cases, diseases of man which are transmissible to animals.

There are at least 100 such diseases known, including the dreaded bubonic plague, a rodent disease transmitted to man by fleas from infected rats; African sleeping sickness, a bovine disease; trichinosis, a swine disease, and leptospirosis, a widespread abortion-causing ailment of domestic animals which can produce a severe liver disease in humans.

The number of Americans stricken with zoonoses each year is not known because official reports are not required on many of these ailments. The number undoubtedly runs into thousands. Tularemia, or "rabbit fever," alone hits 300 to 600 persons a year in this country, and Rocky Mountain spotted fever, a disease of wild rodents transmitted

Condensed from: *The Wall Street Journal* (Feb. 14, '63). ©1963 by Dow Jones & Co., Inc., 44 Broad Street, New York 4, N. Y.

Turkeys can transmit parrot fever to man.

to man by ticks, strikes more than 200 Americans annually.

The incidence of zoonoses has been reduced drastically in recent years by stringent public health measures. Yet, despite advances, zoonoses are receiving increasing attention from public health officials. With many infectious diseases that strike humans only—smallpox and polio among them—rapidly being eradicated, the zoonoses remain a major "pool" of infectious diseases still to be conquered.

Dr. James H. Steele, chief of the Communicable Disease Center's veterinary section, says that zoonoses are particularly difficult to bring under control. Unlike strictly human diseases, the zoonoses involve two hosts, man and animal, as well as the carrier. Thus, to completely rid the nation of a zoonosis would require preventive measures in humans, eradication of the disease among animals that harbor it and elimination of the insects that carry it. This is a large order.

Unless a zoonosis is completely wiped out, however, it could break out unexpectedly anytime. This was tragically demonstrated last fall when an epidemic of encephalitis swept St. Petersburg, Fla., causing more than a dozen fatalities. The disease, named St. Louis encephalitis because of a similar outbreak several years ago in St. Louis, is caused by a virus that infects birds. The virus is picked up from the birds by mosquitoes which can then transmit it to man causing inflammation of the brain.

Such sudden outbreaks of zoonoses are more common than is generally realized. Psittacosis, or parrot fever, was thought to have been brought under control in the 1930s when stringent Federal laws were passed barring imports and interstate shipments of infected birds. Yet in the mid-1950s epizootics of the disease—the equivalent in animals of epidemics in man—began breaking out in domestic turkey flocks. In 1956 nearly 600 human cases of psittacosis, many among turkey raisers and meat processing workers, were reported. Despite extra control measures there are still nearly 100 human psittacosis cases reported annually, many times more than in 1950.

The Communicable Disease Center, an arm of the U.S. Public Health Service, serves as the command center for the widening attack on zoonoses. The CDC has 30 veterinarians on its staff and they, teamed with medical doctors, can be rushed to any community to begin control and eradication measures at the first sign of an outbreak.

In addition, the CDC keeps a

close surveillance of animal populations throughout the nation for signs of epizootics of zoonoses. In San Francisco, for instance, a 15-man CDC laboratory is devoted solely to research and surveillance on bubonic plague, a highly contagious disease that entered North America from Asia in 1900. Although rarely heard of, bubonic plague still strikes occasionally. In 1961 in the U.S. there were three cases of plague, two of them fatal.

One zoonosis which is becoming an increasingly serious problem is salmonellosis. Caused by the salmonella germ, the disease is harbored most often in poultry and swine. Humans, when infected, often from eggs laid by infected hens, suffer effects similar to those of food poisoning. The disease is sometimes fatal.

The concern of public health officers over the spread of rabies among wild animals traces to mid-1953 when the first discovery of a rabid bat in the U.S. was made in Florida. Presumably, the bat rabies crossed the border from Mexico. Since that time, rabid bats have been detected in 30 states. The number of rabid bats detected in 1961 doubled the previous year's figure.

Rats still carry deadly bubonic plague.

CDC scientists have launched an intensive research effort on bat rabies, spending considerable time deep in bat-inhabited caves in the Southwest. One disturbing finding: Bats can spread rabies without biting. One theory is that mother bats, when nursing, excrete the rabies virus.

Fortunately, scientists are making major gains in treating and preventing rabies. The disease is caused by a virus that attacks the brain and nervous system. It is transmitted to humans through the saliva of rabid animals, usually following a bite. If the virus is allowed to incubate two to six weeks, it invariably is fatal, with death following two to six days of fever, paralysis, delirium, convulsions and hydrophobia, or fear of water. For many years doctors have been able to prevent development of rabies with a vaccine. But the vaccine itself sometimes produced paralysis.

Recently, however, Eli Lilly and Co. developed an anti-rabies vaccine made from rabies viruses grown in duck eggs. The vaccine, the company states, does not produce paralysis but affords as much protection as the older vaccine. But health officers say word of the new vaccine has not spread rapidly. Of the approximately 30,000 persons who received anti-rabies shots last year, only slightly more than half got the new vaccine.


Wide World Photo

HENRY KAISER:

"You may live to be 100"

by Leona Elliott

"So vast are the foreseeable advances against disease, that I predict it will be commonplace for members of this generation to live to be more than 100 years old."

Unbelievably energetic at 81, industrialist-builder Henry J. Kaiser is the best evidence in the world for his own statement. *Fortune* magazine once said of him, "Not in all history has any industrial figure successfully gotten into so many and various projects as Kaiser."

Today he is still "getting into" new projects. His most spectacular undertaking at present is Hawaii-Kai, a 75,000-family resort city costing $1 billion in the islands he has come to love.

Tanned and smiling, and dressed in a colorful Aloha shirt and washable denims—the casual attire typical of Hawaii—Kaiser recently discussed his views of science today.

"This is the age of miracles-come-true in atomic energy and other sources of power; in conquest of outer space and the opening up of inner secrets of the universe; in electronics and robot machines; in new metals and a dazzling array of new materials; in chemistry releasing countless new projects and wonder drugs to conquer disease; in aviation hurtling jet planes through space at speeds much faster than sound; an age of chain reaction advances in science and invention and production of the material needs of man."

This is an age in which Henry Kaiser intends to participate fully. At the time of life when most men have long since retired to their memories, Kaiser feels he is just beginning to live. Customarily he is on the construction job at Hawaii-Kai at sunrise and puts in up to 16 hours of work a day. Jet planes, and phones on his desk and at home keep him in constant touch with his world-wide interests.

At the end of a work day, Kaiser goes to his six-and-a-half acre estate in Hawaii-Kai. It fronts for 900 feet on the water, with a panoramic sweep across a far-flung bay out to the sea. He looks directly

out on Diamond Head and Koolau Range, and the view he sees when relaxing after a busy day is spectacular against the amethyst of the bay.

His residence is made up of a series of, rather than one, big building. There are half a dozen different buildings to take care of guests and for other purposes. In this manner, his own home, which he laughingly calls a two-bedroom home, is designed so that he can entertain a few intimate business associates or a large group of guests. Mr. and Mrs. Kaiser's two teen-age sons join their parents in an avid interest in baseball and football, and the Kaiser estate includes kennels where Mrs. Kaiser raises thoroughbred white standard poodles.

Against this colorful background, Kaiser discusses with enthusiasm his ideas of where science and technology are taking us—what they can mean to us in our lifetime. A new scientific revolution is merging into the on-rushing Industrial Revolution, he explains. A research discovery in one science may be combined with hundreds of forward steps in other lines, and thus generate ever greater and swifter advances.

"Research and development," he declares, "have created our most fabulously productive industry—the new Industry of Discovery.

"The psychologist Walter Pitkin," Kaiser continues, "showed that not more than one-fifth of the average man's brain is ever used as it might be, and perhaps half of one's brain remains unused from birth to death. We should not be satisfied with that."

For the future that's right upon us, he believes, our youth must be educated to their maximum capacities . . . "trained to the skills that will be in serious shortage for this Age of Science. And equally important—they desperately need to be grounded in the humanities—in human relations—and in the realms of the spirit.

Doing the 'impossible'

"The jobs ahead call for more ideas and ideals," he continued enthusiastically, ". . . more courage and will . . . more zest for work . . . more brain power. There always will be still tougher so-called 'impossibles.' Personally, I occasionally look back on the past only to goad myself to the faith that the pending 'impossibles' can be done."

Henry J. Kaiser's career is a monument to his refusal to bow to "impossibles." The son of German immigrants, Kaiser started his business career at 13 when he left school to take a $1.50-a-week job as a cashboy for a dry-goods store.

By the time he was in his 30's, his first company, the Henry J. Kaiser Co., Ltd., was carrying out millions of dollars worth of highway construction in the Pacific Northwest and California. In 1927 his company received a $20 million dollar project—huge in those days—to build some 200 miles of highway with 500 bridges in Cuba.

KFS

During World War II Henry Kaiser's companies built more vessels than any other shipbuilder. Here he demonstrates his plan for building prefabricated ships in four days.

Later Kaiser became chairman of the famous Six Companies which combined to build Hoover Dam. He went on to participate in the building of Bonneville, Grand Coulee, and Shasta Dams, and such other projects as the piers of the San Francisco Bay Bridge, levees on the Mississippi River, and pipelines in the Northwest and Southwest, and in Mexico. In 1939 he founded the Permanente Cement Co., one of the two largest in the world.

Although new to shipbuilding, the Kaiser organization produced more vessels during World War II than any other shipbuilder. The postwar growth of Kaiser-managed companies continued to be rapid and diversified. In 1955—Kaiser's 41st year in business—the industrial family had total assets of nearly one billion dollars.

He is a man accustomed to vastness, and he does not balk at vast predictions.

"Let's look at the field of electronics," he went on. "Electronics—with computers and push-button control systems—make it possible to do jobs in factories and offices that before have been too complex

or laborious for humans; tasks of lightning speed and delicate precision. Research is stimulated by the fact that electronic computers can figure out, in seconds, complicated mathematical calculations that would take men tedious years, or forever to complete. Already millions of robots are at work for us in our daily lives. We stand on the threshold of still more startling progress in all phases of electronics." Kaiser's far-future expectations range from supersonic planes to solar-freshened sea water and drugs that will "help you live past 100 years of age."

Controlling all matter

He points out that beyond the splitting of the atom into a chain reaction of nuclear power and still undreamed-of-developments, scientists now probe into the ultimate forces which control the form of the nucleus and thereby control all matter.

With the population increasing throughout the world, cheaper and more plentiful power is needed to expand material civilization to the whole human race, and that would go very well toward averting a third world war.

"Scientists envision the development of a 'solar storage battery' that would accelerate the process of plant biology and produce not only energy, but food and organic raw materials," he declares. "What a challenge to our time . . . to open up sources of limitless power!

"In uses of metals, chemicals, plastics, and synthetics, industry linked with research has barely scratched the surface of new processes and the thousands of new materials and products to come.

"In this air age," he continues, "jet transports already are shrinking world travel time by fully 40 percent. Already we are only a day or so flight-time away from remote spots on any continent. Yet industry leaders tell us that the next major break-through in commercial passenger planes should be to fly us beyond the speed of sound—two-thousand-mile-an-hour planes will fly us from Los Angeles to New York in 90 minutes; New York to Moscow in two hours.

"Around the world in a day, instead of Jules Verne's dream of 80 days!

"This generation can achieve conquests of outer space and discover secrets of the universe as imaginative as science fiction . . . yet as possible as man's faith, and imaginative as research and the will to work."

Amazing prevention and cure

Research advances in health impress Kaiser deeply. If we don't all live to be 100, he says, "this generation should have a good, long healthy life span in which to enjoy the wonders-yet-to-be.

"Men of medicine, the biological sciences and chemistry are at the threshold of amazing prevention and cure of disease.

Kaiser at Hawaii-Kai, his 75,000-family resort city that is now being constructed at a cost of $1 billion. He calls this project his "biggest yet."

"Men are living today who would have died not many years ago without today's antibiotics, sulfa drugs, and anti-malarials.

"Now will come a floodtide of discoveries about how to regulate the body chemistry and metabolism, how to deal with viruses, and how to use the hormones, vitamins, and still new wonder drugs."

The scourges of cancer and heart disease, he believes, will before long be laid as low as tuberculosis and polio. Meantime, there will come an all-out attack against mental illnesses which arise from upsets of emotion and mind.

Kaiser feels a new age of opportunity is opening for young people.

"We can look forward to the need, more than ever before, for trained and educated men and women. We are going to be critically short of men and women who will be prepared to measure up to the needs of the future, unless we fully develop the environmental stimulus to match the time of gigantic innovation. Already we are desperately short in bringing forth leaders in a great many of the humanistic fields and in the realm of the spirit and in the cause of lasting peace. The enormity of the coming needs spells tremendous opportunity for men and women of vision and purpose who will arise to achieve the best within themselves."

New opportunites opening

What kind of a tomorrow are we going to build? What will the United States be like in the mid-1970s and by the year 2000? Here is what Henry Kaiser has to say about the world of tomorrow.

"New horizons and opportunities still will keep right on opening . . . The experts look at the long-pull trends. The trouble with short-run estimates often is that forecasts just for this year may be conflicting and confusing, perhaps influenced by a

temporary situation or clashing theories. Under short-range estimates, the forecaster may miss the forest for the trees."

But a long-range forecast, he feels, takes account of the historic past performance of our economy and projects the trends that should prevail. He cited a government report of projections to the years 1976 and 2000.

"Only 13 years from now, in 1976," Kaiser says, "this country's annual output of goods and services will reach about one thousand billion dollars.

"Our employment will exceed 92 million . . . with the labor force one-third again as large as now.

"Almost 70 percent of American families will be earning, at current prices, more than $6,000 a year.

"America's population will top 235 million people."

350 million Americans

Scientists and free enterprisers, he adds, are making breakthroughs in every field, and in the year 2000, just 37 years from now, this is what, in Kaiser's opinion, America will be like:

The nation will have 350 million people—twice as many as today.

The goods and services produced annually will reach $2,000 billion dollars—almost four times our current gross national product.

The average family's yearly income—after taxes and in today's dollars—will soar to $14,750.

Fifteen times as many families as today will be earning $20,000 a year and up.

Werner Stoy

Kaiser is customarily on the job at Hawaii-Kai at sunrise and puts in a 16-hour day overseeing all details of the work.

"I don't for a minute blink at staggering forecasts like these," Kaiser chuckles. "I remember being warned years ago, 'Henry, don't be fantastic . . . don't soar into the wild blue yonder,' when I urged—let's set our goals for the postwar at 60 million jobs and 400-billion-a-year economy in the United States. Yet that target has been well exceeded."

His forecast continues: Spending for housing will triple.

By the turn of the century, we will almost double today's number of jobs. There will be 135 million people gainfully employed.

Their average work-week will be 30 to 31 hours—some eight hours less than now.

Americans will have month-long vacations as a rule. They will travel nearly three times as much as now

—on the average 11,000 miles a year per person.

At this time of new and unprecedented opportunities, he urges that you find the needs for tomorrow—to make life fuller, richer, more meaningful, more satisfying to the inner individual.

"The revolt is rising to rebuild our huge but decaying, traffic-clogged, nightmarish cities," he said.

"Let us resolve that increasing affluence and leisure shall not bring wasteful idleness, heedlessness, and the rot of soft living."

Spending for the arts

He predicts that a tremendously greater number of people will engage in a gigantic upsurge of the service businesses and trades. . . . We will spend far more for all the cultural arts. . . . We will seek to create a climate more rewarding to the life of the intellect, the arts, the learning and adventure of travel—all the self-fulfillments of human growth.

A towering strength of the American people's free way of life is our system's ability to meet constant changes. "Freedom for Americans means nothing is ever finished."

"We are not under the dictator rule that we cannot improve ourselves as individuals. The worth and dignity and freedom of the individual are paramount.

"The people's right to vote in free elections guarantees the people's veto over the abuse of power and the right to accomplish changes to meet the public will . . . It is the genius of the people that they have proved they can make democracy work, however fierce are the onslaughts against it.

"It is my abiding faith that our system of freedom under law and justice will endure and prevail, both at home and ultimately around the world.

"The talent for struggling through and coming up with ever-better solutions should mean, for one thing, that employers and employee unions can find a better way than crippling strikes to arrive at an equitable sharing of the fruits of productivity. . . .

The grandest achievement that could usher in the 21st Century, Kaiser believes, would be that our age should succeed in extending the benefits of civilization to the entire human race.

You can help

"Win we must," he said strongly, "and it's my faith we will win mankind's ceaseless struggle to avert another world war and to attain peace and freedom."

This dip into the future suggests that each and every one of us do our part. Henry J. Kaiser believes the prospects are limitless as the minds and hearts of men, yet as real as the bold imagination, the faith, the love, and the will to work that men can unleash.

And may you never underestimate, he says, the part you, yourself, can take.

YOUR SCIENCE ABC's

The fascinating world of science is closed off to many of us because we have forgotten or don't know the ABC's of science. Science Digest herewith inaugurates a new feature with the thought that many will benefit from a regular, simply written review of the basics of science.

Atoms and molecules

All matter—whether solid, liquid or gas—is made up of very small particles called molecules. Molecules in turn are made up of atoms, which are smaller particles still. The difference between molecules and atoms is this: a molecule of any substance, say, wood, is wood—the smallest bit of wood that you can have. If you break it down any further, what you get is not wood, but the individual atoms of which the wood molecule is composed. In the case of wood, these atoms happen to be chiefly carbon, hydrogen and oxygen.

The story of the atom goes back to the time of the Greek thinker Democritus (about 460 B.C.). He thought that all substances were made up of tiny particles or atoms which could not be further divided. The learning of the ancient Greeks was not followed by further discoveries in science.

An important phase was finally reached with the work of John Dalton (1766-1844). Like Democritus he put forward the idea that all matter was made up of atoms, but, unlike Democritus, he believed that there were many elements. Democritus, on the other hand, thought that there were only four: fire, earth, air, and water, and that all materials were made up of mixtures of these. The modern science of chemistry was founded on Dalton's ideas, and for many years after his death it was thought that the atom was the tiniest particle of matter, until some very wonderful discoveries were made toward the end of the nineteenth century.

In 1896 Henri Becquerel noticed that uranium salts gave out strange

rays which could darken a photographic plate; in this way he was the first to discover radioactivity, a natural process which has been going on since the world began.

Madame Marie Curie believed that these peculiar rays were given out by a chemical element in the uranium ore, and after much patient research and experiment she discovered and separated it, and gave it the name "radium," or "shining element." Now, the remarkable thing about radium is that it gives out energy in the form of radiations all the time. Very careful studies were made of the radiations given off from radium and uranium. It was noticed that radium lost a minute amount of weight after a long time.

Energy from the atom

Scientists, like Albert Einstein, showed that when a body gave off radiations or was radioactive, to put it another way, the tiny loss in weight was due to the fact that some of the matter turned into energy. Where did all this energy come from? Scientists began to think it came from inside the atom itself.

Sir J. J. Thomson, towards the end of the last century, discovered the electron, a tiny particle charged with negative electricity inside the atom.

In 1911 Ernest Rutherford (later Lord Rutherford) discovered that the atom had a core or nucleus in its center, and that this nucleus was positively charged and contained nearly all the weight of the atom. He showed that the positive charge on the nucleus was caused by subatomic particles called protons. What puzzled him was that the protons did not account for the whole weight of the nucleus, but the mystery was not solved until 1932, when it was proved that it contained not only protons, but neutrons which are subatomic particles without any electric charge. The weights of these particles were calculated very carefully and it was found that the proton and neutron have almost the same weight, but that the electron weighs only about 1/2,000th as much as a proton or neutron.

The atom as we think of it today is mostly empty space. In the center is a tiny core or nucleus containing neutrons and protons. Electrons orbit around the nucleus at a distance which is really very small, but is large for the tiny world of the atom. Other particles have been found inside the atom, but protons, neutrons and electrons are the main bricks of atomic structure.

What are the atoms of some of the simplest elements like?

An ordinary hydrogen atom has a nucleus with only one proton in it, and one electron orbiting round it. The atomic weight is 1. Another form of hydrogen has 1 neutron and 1 proton in its nucleus, but only one electron turns round it. This is called heavy hydrogen, or "deuterium." It has the same chemical properties as ordinary hydrogen, but its atomic weight is 2. There is a

third form of hydrogen with two neutrons and one proton in the nucleus. Again it has only one orbiting electron. This extra heavy hydrogen is called "tritium" and has an atomic weight of 3. Like deuterium, tritium has the same chemical properties as ordinary hydrogen, and these two substances are called hydrogen isotopes.

Ordinary helium has two protons and two neutrons in its nucleus, and two satellite electrons. It is element number 2 because each atom has two protons in its nucleus. To find the atomic weight we add together the two neutrons and two protons which is 4. As these facts about atomic structure are important, perhaps it would be better to list them as follows:

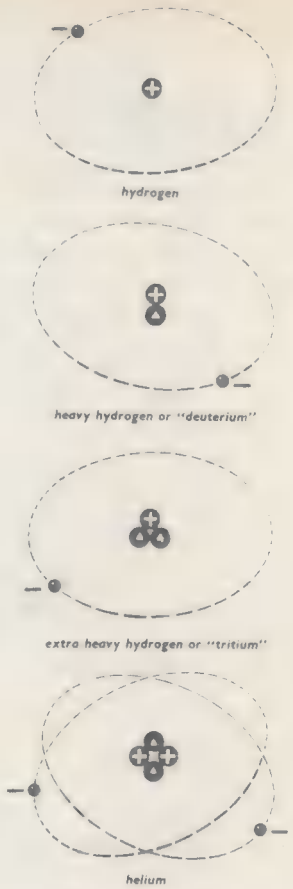
(1) The number of an element is the number of protons in its nucleus.

(2) The electrons are the same in number as the protons.

(3) Add together the neutrons and protons to get the atomic weight. The weight of the electrons is too small to make much difference.

(4) Notice that the atomic weight of ordinary hydrogen is 1, and that the atomic weight of an element tells us how many times heavier it is than hydrogen. Dalton knew that hydrogen was the lightest element and it was he who gave it an atomic weight of 1, so that the weight of other elements could be compared with it.

We could similarly study other elements, but we will take only one more—uranium—because of its great importance in atomic science. Uranium is element number 92 because its nucleus contains 92 protons. Natural uranium consists of a mixture of two forms, or isotopes, of uranium. One isotope of uranium contains 92 protons and 146 neutrons in each nucleus. The other



The hydrogen atom has a single electron (—) orbiting around a nucleus of one proton (+). Its isotopes still have only one electron but deuterium has a neutron (triangle), added to the nucleus, and tritium has two neutrons. Helium has two electrons and two protons.

contains 92 protons and 143 neutrons. Thus their atomic weights are 92 + 146 = 238 and 92 + 143 = 235. These are known as isotopes U-238 and U-235. There is 140 times more U-238 than U-235 in natural uranium.

U-235 can be used to generate atomic power. U-238 can be also, but first it must be converted into plutonium, element number 94, which, like U-235, undergoes "fission"

How molecules are made

When atoms combine to form molecules—as when an atom of carbon combines with two atoms of oxygen to form a molecule of carbon dioxide, or an atom of sodium and an atom of chlorine to form sodium chloride—they are held together by their outermost electrons. This can come about in either of two ways. In carbon dioxide, the carbon and oxygen atoms share electrons. In sodium chloride, the chlorine atom captures an electron from the sodium atom. This gives the chlorine an extra electron and leaves it with a negative electric charge. The sodium atom, on the other hand, is short an electron, leaving it with a positive charge. Since unlike charges attract each other, the chlorine and sodium atoms are attracted to each other and link together to form a molecule of sodium chloride. Some molecules contain tens of thousands of atoms linked together. Examples are the molecules of protein, the chief substance of living tissue.

Atomic power

An atomic power plant resembles an ordinary power plant in all respects save one. Just as an ordinary power plant, it has generators and steam turbines to drive them. The difference is in the way the steam is obtained. Instead of raising it by burning coal or oil, the atomic plant uses energy from the splitting of atoms, usually from a form of uranium 235 or plutonium. Why split atoms instead of burning coal? A pound of U-235 can furnish as much heat as a thousand tons of coal. The secret of atomic energy lies in the peculiar character of atoms like those of U-235.

The nucleus of element 92, uranium, contains 92 protons and, usually, 146 neutrons. But in U-235 there are only 143 neutrons, barely enough to hold the nucleus together. When it is penetrated by an extra neutron, the U-235 nucleus undergoes "fission" or splits into two fragments. The two pieces do not quite add up to the original U-235 atom. A tiny bit of the original atomic matter is converted into an enormous amount of energy, and two or three neutrons are shot out. These in turn may split the nuclei of other U-235 atoms, setting off a "chain reaction."

Carbon dioxide gas is pumped in and heated by the fission reaction. When the carbon dioxide is hot enough, it is led by pipes to water

A diagram of fission. A free neutron strikes the nucleus of an atom (1). This unbalances the nucleus and it splits into two parts. In the process a tiny bit of the nucleus is converted to energy and two or three extra neutrons are shot out. These may split other atoms and set off a chain reaction.

boilers, where it is used to raise steam.

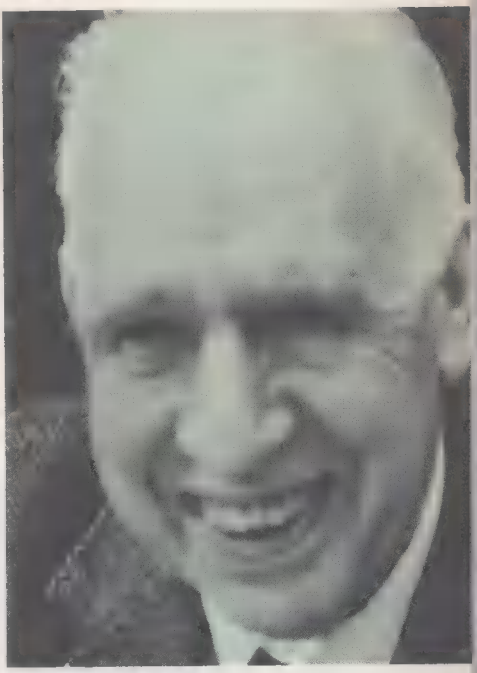
In some reactors, water is used instead of carbon dioxide as the "heat exchange medium." Still other substances might be used.

Research scientists are working on an even more remarkable scheme for obtaining power from the atom. While heavy atoms can be made to release energy by splitting, light atoms, such as hydrogen, can yield energy by being fused together. The process is called "thermonuclear fusion" or just "fusion" and it releases energy because the fused atomic nuclei are a little lighter than the separate parts; the difference appears as energy. For instance, four atoms of hydrogen weigh 4.032 atomic units. If they are fused to form a helium atom, the resulting helium atom will weigh only 4.003 units. The difference—.029 unit—appears as energy.

Fusion is the process by which stars generate energy. Man has duplicated a form of the fusion process here on earth. The hydrogen bomb is a fusion bomb. Work on taming the H-bomb and using the fusion process for generating electricity is going forward in several countries.

A Science Milestone

A famous physicist recalls the warmth and intellect of a friend



Niels Bohr

The man who explained the atom

By George Gamow

NIELS Bohr and Albert Einstein were the two greatest theoretical physicists of our era. But Einstein and Bohr, who died last year in his native Copenhagen, worked in different ways.

Einstein, though always very amiable and kind, was a lone wolf in his work, and very few physicists can say, "I was Einstein's student." By contrast, Bohr could claim dozens of spiritual sons all over the world. His Institute for Theoretical Physics was always crowded with young physicists from different countries, and we proudly called ourselves "Bohr's Boys."

One of our duties was to take Bohr to the movies and to explain the plot to him. He was a slow

thinker, and always asked questions. "Is this the sister of that cowboy," he would ask, "who shot the Indian who tried to steal a herd of cattle belonging to her brother-in-law?" He was an addict of American Westerns with such titles as *The Gun Fight at the Lazy Gee Ranch* or *The Lone Ranger and a Sioux Girl* when they appeared at one of the Copenhagen theaters. And he never missed films starring Annie Ondra (the Czechoslovakian equivalent of Mary Pickford), probably because, having six boys, he liked to see a girl.

I first met Bohr in 1928. That spring I was graduated from the University of Leningrad and was granted a fellowship to attend summer school in Gottingen, one of the best German universities.

In the middle of that summer, I struck a scientific gold mine. I had been trying to apply wave mechanics, which had been discovered only two years earlier, to the then mysterious problem of radioactive decay. I was able to explain by quantum mechanics how a decaying atom ejects an alpha particle, or helium nucleus, to become

Bohr's Boys of the '30s: l. to r., Dr. Lev. D. Landau, Aage Bohr, the author, Ernest Bohr and Dr. Edward Teller.

a new element with a smaller nucleus. My theory also worked in reverse. It showed how a nucleus could absorb an atomic particle shot at it to become a new element with a larger nucleus.

The summer and my money were coming to an end and I had to return home to Russia. But I wanted very much to visit Niels Bohr, the creator of the quantum theory of the atom, and I bought my return ticket through Copenhagen. I phoned Bohr's secretary, Frocken (Miss) Schultz, and she told me that he would see me that afternoon at the Institute, which Bohr headed.

The brew that is true

I met Bohr in the Institute's library. He asked me what my interests were and on what problems I had been working recently. So I told him my new theory of radioactivity. He was very much interested, and asked me several questions. Then he said: "Listen, Gamow, would you like to spend a year here if I arrange for you a Carlsberg fellowship in our Royal Academy of Sciences?" Needless to say, I agreed, and was in seventh heaven. Frocken Schultz found me some very good rooms close to the Institute, and I went on with further studies and research.

It is perhaps interesting to remark here that the Institute and the Royal Danish Academy of Sciences (of which Bohr was a permanent President and I am now a foreign member) own the Carlsberg Brewery, obtaining their revenue from it. The brewery was willed to the Academy by the man who gave the brewery his name. He willed his palatial house, located amid the brewery grounds to Bohr himself. The famous scientist lived there for many years until his death.

The charm of Niels Bohr was matched only by the charm of his wife, Margrethe. Of their six sons, the eldest, Christian, drowned as a teen-ager, after falling from a yacht during a storm, and the youngest died in early childhood. But Aage, Erick, Ernest and Hansa are doing very well. Aage followed in his father's footsteps. An eminent physicist, he has inherited the directorship of his father's Institute.

Bohr loved Denmark and was very unhappy when some other country was one up on his native land. Once his brother Harold, who was as good a mathematician as Niels was a physicist, was returning from a visit to Stockholm. Niels, Fru (Mrs.) Bohr, some of their children, Harold's wife, their children, and I went on a ferry boat across the Sund to meet Harold's train arriving at Malmo. In Europe, in order to be allowed on the station platforms, one has to purchase a special ticket costing about five cents, and Bohr went to the machine to get tickets for the whole crowd. When he returned with the handful of tickets, he was unhappy because the Swedish railroads were evidently more ingenious than the Danish. "At home," he said, "the ticket machines are operated by

electricity. Swedish machines have a sign telling the purchaser to step on a little platform in front of the machine before depositing the coin. Thus everything is operated by gravity." When we came to the gates, and Bohr presented the tickets, the attendant refused to let us through. "They are not platform tickets, sir," he said, "they just show your weight."

In his youth, Bohr was a very good soccer player, and remained sports-minded through the later years. Once, Bohr, Fru Bohr, I, and a young Dutch physicist, Cas Casimir, were returning late in the evening from a movie. We walked along the deserted streets and passed a bank building on the corner. The facade of the building was made of large cement blocks, the spaces between which formed excellent footholds for an alpinist. Just for fun, Casimir climbed up a couple of floors. When he came down, Bohr decided to match the deed and slowly went up the wall. When he was precariously hanging between the first and second floors, two Copenhagen policemen on their night beat approached quickly from behind with their hands on their holsters. They looked up, and one of them said: "Oh, that's only Professor Bohr!"

During World War II, when Denmark was invaded by German troops, Bohr remained in Copenhagen to help others. He was able to do little, and decided to escape in 1943. In the dead of night, a Danish fisherman rowed him over to the Swedish shore, where he was picked up by a British Mosquito bomber. Bombers do not have much space for passengers, so Bohr was given a small place behind the bomb bay. During the flight over the North Sea, the pilot tried to contact him by intercom, but Bohr did not answer. As soon as the plane landed, the pilot rushed to the rear, fearing the worst. But everything was all right. Bohr had simply fallen asleep and had not heard the call.

Secret scientist

After his escape, Bohr came to the United States and went directly to Los Alamos, where he was badly needed in the development of the A-bomb. Because of security regulations, he had a passport bearing the name Nicholas Baker, and all the Los Alamites called him affectionately "Uncle Nick."

The name led to an amusing incident when Bohr was riding in a New York or Washington elevator. At one of the stops a woman whom Bohr knew very well entered the elevator. She was a former wife of a physicist, whom I will call Dr. Buscher for security reasons, who had often visited Copenhagen before the war. What Bohr did not know was that in the meantime the lady had been divorced and married to another physicist, Dr. Kulachek (another fictitious name). Recognizing Bohr, in spite of the dark glasses he was wearing, the lady said: "Aren't you Professor Niels

The Bohr clan, Dr. and Mrs. Bohr surrounded by their real family: four sons, their wives and eleven grandchildren.

Bohr?" "No," answered Bohr, "I am Mr. Nicholas Baker." Then, feeling embarrassed by his refusal to greet an old acquaintance, he added: "But I do know you; you are Mrs. Buscher." "No," snapped the lady, "I am Mrs. Kulachek!"

During the postwar years and until his death, Bohr was busy in many fields. He worked hard for world peace, and the organization known as CERN (Centre European de Recherche Nucleaire). In 1957 he received the first Atoms for Peace Award from the Ford Foundation for his efforts in finding peaceful uses for nuclear energy. When I visited him in 1961 in his country house in Tisvilde, he was as jolly a fellow as always, and was working hard on a new theory of superconductivity.

Bohr's scientific career began with his arrival in Cambridge at the age of 26 (in 1911) to work in the Cavendish Laboratory. The director of the Laboratory was the famous British scientist, Sir J. J. Thomson, who discovered the electron. Things did not go well for Bohr in Cavendish. He strongly disagreed with the model of the atom constructed by J. J. (as his colleagues and students called him).

After a few heated discussions with J. J., Bohr packed his bag and took a train to Manchester. There, the great New Zealander, Ernest Rutherford (later Lord Rutherford) was carrying out his epoch-making experiment on the bombarding of the atom by high energy alpha particles emitted from radioactive substances. From these experiments it followed that all the positive charge of an atom and practically all its mass were concentrated in a very small region near the center of the atom which Rutherford called the atomic nucleus.

Although Rutherford's model of the atom was a direct and inevitable

consequence of his experiments, it drastically contradicted all basic laws of classical physics that had been formulated up to that time.

Electrons circulating around the nucleus carry a very large electric charge. Electrons moving on a large scale, as in wires, emit electromagnetic radiation. Radio is one application of this principle. Physicists expected electrons in orbit around the nucleus to radiate energy also. However, calculations showed that the electron would radiate energy so fast that it would spiral into the nucleus within one hundred millionth of a second, ending the life of the atom. In reality, atoms of common chemical elements exist for eternity.

X-ray table lamps

Bohr did all he could to help Rutherford. To do so, he had to draw upon new theories that in the preceding decade had drastically altered the picture given by classical physics. Out of classical physics had grown the kinetic theory of gases, which assumes that a gas is made up of an extremely large number of minute molecules. When trying to apply the theory to radiation from gases, the British physicists Lord Raleigh and Sir James Jeans had arrived at a dead end. If they followed the rules of the kinetic theory and classical physics, a gas appeared to be able to radiate in an infinite number of wavelengths. As a result, the energy of radiation at any one wavelength would be zero. The rules also said that as the radiating electrons spiralled into the nucleus the frequency of the radiation would grow higher and higher. White light from an ordinary table lamp would turn blue, then to X-rays, then to deadly gamma rays, and on to ever shorter wavelengths. Both conclusions, although logical by the rules, were nonsense.

Color-coded energy packages

In the year 1900, a German physicist, Max Planck, had solved the Raleigh-Jeans paradox by stating that classical physics, no matter how well-established it was, must be changed if it contradicted more recent observation. In his famous address at the Christmas meeting of the German Physical Society, he proposed that radiant energy must be assumed to exist only in the form of certain energy packages or *light quanta*. The amount of energy in each individual light quantum, he said, is equal to the frequency of light (the number of vibrations per second) multiplied by a universal constant which Planck called the letter *h*. This revolutionary idea was subsequently substantiated by the study of the photoelectric effect (ejection of electrons from metals by ultraviolet light) and the Compton effect (scattering of light by free electrons).

When Planck had presented his paper, Bohr was 14 years old. Now, at 26, he developed the theory fur-

Niels Bohr and his wife ride the author's motorcycle.

ther. If radiant energy is quantized, argued Bohr, why should not mechanical energy of electron motion within the atom also be quantized? In Bohr's new scheme, the energy of electrons circling around the nucleus did not change continuously, but in jumps. Orbits for the electrons, he reasoned, are precisely spaced tracks. An electron with the least energy travels in the innermost orbit. Electrons with a certain, specific amount more energy are in the second orbit, and so on. When an electron goes from its orbit to one closer to the nucleus, it loses the difference in energy by radiation, throwing off a light quantum. The light quantum has a specific frequency to match its energy. Thus when light from a radiant gas is split into its components, or spectrum, the result is not a rainbow, but lines which represent light of specific frequencies.

Thirty years before Bohr took up this problem, a German schoolteacher named J. J. Balmer, who liked to fool with a spectroscope, found a remarkable numerical relation between the frequencies of various spectral lines in the light emitted by excited hydrogen gas. These hydrogen lines in the visible part of the spectrum (Balmer series) were interpreted as being due to electron jumps to the second orbit from outer ones.

Witch's rule explained

Bohr's interpretation meant there should be jumps to other orbits producing spectral lines outside the visible spectrum. Later these lines were discovered by Lyman in the ultraviolet, and by Paschen in the infra-red. Their discovery proved that Bohr's theory of the internal structure of the atom and the emission of spectral lines was right.

The first decade of Bohr's theory of atomic structure is a saga of glorious successes in our understanding of the structure of matter. The empirical laws of spectroscopy which remained mysterious for several decades (one of them was ironically called "witch's rule") could now be understood as a logical consequence of Bohr's atomic model. The periodic table of chemical elements was explained as due to successive filling of the quantum orbits by atomic electrons. The theory permitted us to predict physical and chemical properties of the elements

that had not been identified. It also permitted us to understand the forces that bind atoms into molecules and led to quantum chemistry.

Bohr was rewarded with the Nobel Prize in Physics in 1922.

Toward the end of the that eventful decade physicists found that Bohr's model of the atom was too simple a base on which to build more theory. It was becoming more and more clear that Bohr's model represented only the skeleton of an atom and that some flesh should be added to it. In the year 1924, a French theoretical physicist, Marquis Louis de Broglie, conceived a seemingly fantastic idea that the positions of the different quantum orbits in Bohr's atomic model are determined by mysterious waves, now known as de Broglie waves. There is one de Broglie wave on the first Bohr's orbit, two waves on the second, three on the third, and so forth. The orbit must be just large enough so that the waves fit exactly around it. Two years later, an Austrian physicist, Erwin Schrodinger, expanded de Broglie's original ideas and wrote his famous wave-mechanical equation, which supplied the desired flesh for Bohr's skeletal model of an atom.

The physical nature of these waves remained a mystery until a young German physicist, Werner Heisenberg, interpreted them as representing the mathematical probability for finding an electron at a given place and moving with a given velocity. For example, one could think of the peak of the waves as representing the most probable place to find an electron, and the trough as the place it is least likely to be.

It is impossible to locate the electron precisely, because, Heisenberg showed, the quantum theory precludes an exact simultaneous knowledge of the position and velocity of a moving particle. The very act of looking at the particle changes both, resulting in a certain minimum inaccuracy, or as Heisenberg called it, uncertainty.

Einstein admits error

Visiting the University of Gottingen where Heisenberg was teaching, Bohr heard his ideas and liked them very much. He asked Heisenberg to get leave and come to work with him in Copenhagen.

From this time on, Bohr pursued his new hobby—the principle of uncertainty, and the dualistic point of view that it created in quantum physics. He extended this principle, which was originally developed for an electron, to a much more complicated case of an electromagnetic field, and he developed an entirely new philosophy of the relation between observation and knowledge.

Characteristic for that period was the long-lasting dispute between Bohr and Einstein, who did not want to recognize the validity of the uncertainty principle. Finally Einstein gave up and agreed that this principle was faultless. He added: "But I still do not like it."

FOUND: Million-acre cow pasture

In remote, subarctic Canada, soil surveyors have discovered a huge tract of arable land that promises plentiful food for a growing region.

By George A. Yackulic

A MILLION acres of arable land have been discovered in Canada's far northland—in a virgin wilderness region where local production of foodstuffs is becoming increasingly precious with the development of a huge lead-zinc mining complex.

According to Frank S. Nowosad, the expert on northern agriculture for the Canadian government, a discovery of 1,000,000 acres of arable land in one district in this era is "most surprising."

This potential farming land, expected to be in production within 10 years, is contained in a 200-mile stretch of the Liard River Valley between Fort Liard and Fort Simpson in the Northwest Territories.

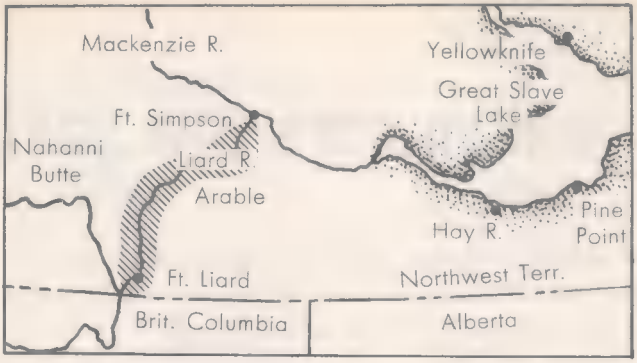
It was discovered during a recent soil survey by J. H. Day of the Canadian Department of Agriculture Soil Research Institute in Ottawa. The discovery, fabulous because of its geographical location and great promise, gives visionaries new evidence of the economic potential of Canada's remote northwest.

The survey, which found the rich, brown farming soil beneath a forest cover of poplar and spruce, was part of a Canadian government plan to map all districts in the Yukon Territory and in the Northwest Territories having agricultural possibilities.

Earlier, approximately 220,000 acres of arable land had been uncovered in the same vicinity, but westward, in the Takhini and Dezadeash valleys of the Yukon, through which the Alaska Highway runs.

Previously, the amount of arable land in the entire Mackenzie River basin had been estimated at no more than 1,000,000 acres.

From Fort Liard in the southwest corner of the District of Mackenzie,



The arable land discovered will help provide food for the miners now moving in to work the vast ore deposits on Great Slave Lake.

the Liard River Valley with the newly discovered farmland runs northwards to Nahanni Butte, then northeasterly to Fort Simpson at the junction of the Liard and Mackenzie Rivers.

To the east, on the south shore of Great Slave Lake, development is just starting on vast deposits of lead-zinc ores at Pine Point, where a large town is expected to grow rapidly within a few years.

A 435-mile railway now is being built towards Pine Point from northern Alberta at a cost of $86,000,000, to haul out lead-zinc concentrates and help to develop the wilderness region.

The bulk of the best land in the new discovery is in the Fort Liard-Nahanni Butte section, where the sweeping "S" curves of the Liard River provide better drainage. For the rest of the route, the river follows a comparatively straight course through poorly drained land.

The surveyed portion of the Liard valley ranges in depth from two to 15 miles on each side of the river and contains 1,753,000 acres.

Day rates 359,000 acres as good arable land, 263,000 as fair, and 319,000 as poor. The remaining 812,000 acres of land is rated as nonarable.

The better arable land was found largely on the well-drained alluvial terraces within one to three miles of the river.

Meat for Miners

The land is best suited for livestock farming, in the opinion of Nowosad, and thus would provide much-needed meat for the large numbers of mining, lumbering, and other workers who will be engaged in that part of the northland in the near future.

Brome, timothy, and other cultivated grasses would thrive and provide hay and pasture, while some of the poor and non-arable areas could serve as rough pasture for livestock.

In addition, early oats and barley

would provide concentrated feed for winter rations and permit dairying operations to provide more foodstuffs that now must be flown into the region at great cost.

Nowosad also is convinced that the new area could produce the same kind of farm and garden crops as those already grown at the Canadian Government's experimental farm at Fort Simpson.

Good crops of many of the hardier kinds of vegetables can be grown there without protection against frost. With the use of plastic covers, such tender vegetables as sweet corn, tomatoes, cucumbers, and peppers can be produced with acceptable quality.

At the Fort Simpson experimental farm, too, strawberries and raspberries ripen satisfactorily most years.

Now—70-hour roses

THE LIFE OF A ROSE may be just a bit rosier—and longer—because of recent experiments with an industrial gas used in the manufacture of common household items. An apparent increase in the life of cut flowers was noted when they were exposed to ethylene oxide, a colorless, sweetish gas.

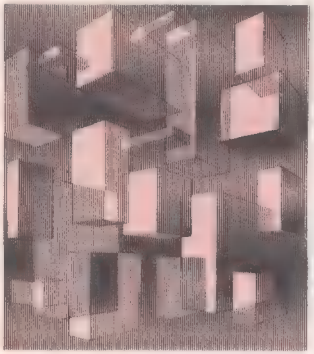
In tests by the Department of Agriculture, cut roses kept for 20 hours in an atmosphere containing .25 percent ethylene oxide did not completely open their buds for as long as 70 hours. Unexposed rosebuds opened completely within 40 hours. The exposed flowers kept their color better and retained petals longer.

The experiments were conducted at the Agricultural Research Center, Beltsville, Md. Plant physiologist Dr. Sam Asen and physiologist Dr. Morris Lieberman caution, however, that their research is still in the beginning stages. Much work remains to be done before ethylene oxide can be recommended as a safe, practical technique for the florist industry: Safe limits for use of the gas must be precisely established. Drs. Asen and Lieberman have already found that concentrations above .3 percent are injurious—in experiments the rosebuds did not open and eventually turned brown.

Chambers for the safe and efficient application of the gas must be designed. The scientists point out that high concentrations of ethylene oxide can be toxic to humans. Finally, studies must be done to determine the most effective amount of ethylene oxide concentration and the most effective holding time for each variety of cut flower.

The experiments with roses grew out of tests in England last year in which Dr. Lieberman and Dr. L. W. Mapson at the Low Temperature Research Station, Cambridge University, England, used ethylene oxide on green tomatoes. The ripening of green tomatoes was delayed five to 21 days when held in an atmosphere containing ethylene oxide. Then normal ripening was resumed.

The effect of ethylene on plants is associated in some way with the metabolism of aging. Treating either tomatoes or roses with ethylene oxide retards the normal maturing process. Drs. Asen and Lieberman found that after the roses were exposed to the gas for 20 hours, they continued to emit small amounts of ethylene oxide for about three days.



INVENTIONS PATENTS PROCESSES

How to Climb a Ladder And Stay Up

Dubl-Lock, a safety device designed particularly for workmen, is said to limit falls from ladders to six inches, according to its manufacturer, Atlas Safety Equipment Co., Inc., 179 North 10th St., Brooklyn 11, N.Y. It consists of an aluminum sleeve which has two independent locking mechanisms, a length of stainless steel cable which is connected to the ladder, and a safety belt.

As the user climbs the ladder, the sleeve rides the steel cable, following his movements. The user, wearing the safety belt, is secured to a safety lever on the sleeve. The safety lever automatically engages both locking mechanisms if he loses his footing.

Forest fires made to order

A NEW training device, designed to reproduce the atmosphere of a real forest fire command post, is being used to give Forest Service personnel a taste of fighting large-scale fires.

The training aid, which allows 12 trainees to be seated at tables facing an 8 by 12 foot screen, was developed by International Electric Corp., a subsidiary of International Telephone and Telegraph Corp.,

U. S. Forest Service men participate in a training exercise with the help of a new fire simulator which projects a motion picture of a forest fire scene. The simulator will give forest service personnel a taste of problems raised when fighting a large-scale fire.

New York, N.Y. With its aid, viewers can watch, as though from a fire fighting command post, the smoke and flames of a fire as an on-the-spot fire boss would see it.

One of the trainees acts as the fire boss, with the others serving as members of his staff. By using communication equipment the trainees can "make contact" with other locations by ground-to-air radio, and ground-to-ground radio and telephones. The training staff consists of an effects operator, a role player, and an umpire.

During a typical exercise the effects operator projects on the screen an aerial view of a forest area. The umpire gives such information as weather conditions and types of fuel in the path of the fire. The role player, taking his cues from the umpire, plays the part of such outside agencies as the weather bureau, aerial support, and police departments.

Trainees can cope with the changing situation by calling up helicopters to be used as spotters, firefighting aircraft, and personnel. The umpire evaluates the effectiveness of the steps they have taken, and the fire grows or is checked accordingly.

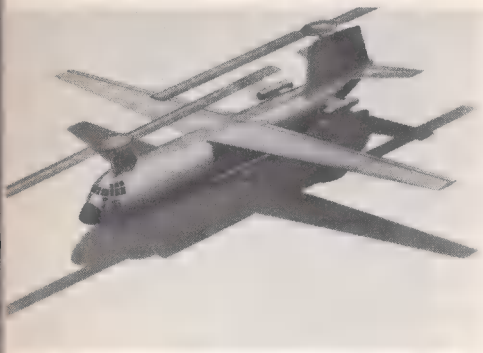
During the exercise, "nuisance problems" designed to create pressure on the trainees are introduced. For example, a role player will tell the trainee that a traffic jam (people coming to see the fire) is blocking the road and delaying water trucks. Seconds later the role player will excitedly claim that summer campers are in the fire area.

Videotape Recorder Captures Programs for Playback

Especially intended for closed-circuit television recording, the VR-1500 Videotape recorder can tape television programs or live action for later playback. Its manufacturer, Ampex, Redwood City, Calif., expects it to find wide use in education, industry, training, medical science, sports, and other fields.

The portable recorder is the size of a suitcase, one-twentieth the size of previous models, and weighs 130 pounds. It is one-fourth the cost of previous models of the Videotape recorder, according to the manufacturer.

The company has already started installation of ten closed-circuit television recording systems to help pilots in the navy with aircraft carrier landings. Known as PLAT (Pilot Landing Aid Television) a television camera can now be used to appraise a pilot's landing technique and the pilot himself can see a playback through Videotape. Two television cameras follow the course of the plane through its approach and landing. Cross hairs on the monitor help the Landing Signal Officer "talk" the pilot through a safe landing. Time, air speed, wind velocity, and flight number are indicated on dials above the television picture, and conversations between the Landing Signal Officer and pilot are recorded. Later the pilot need only switch on a Videotape recorder to receive an instant playback of his landing.



One solution to cargo hauling in underdeveloped areas of the world would be this hybrid helicopter-airplane suggested by a scientist at Lockheed.

Helicopter Hybrid Suggested For Underdeveloped Areas

A hybrid helicopter-airplane to haul cargo to underdeveloped areas has been suggested as an alternative to building high-cost highways. Such a winged and rotor-bladed vehicle would combine the performance of a helicopter and a conventional aircraft. The plane was proposed at the first United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas by Dr. Phillip R. Carlson, research director for aircraft, for Lockheed.

The hybrid helicopter would be able to carry a 25,000 pound payload. It would usually be used for distances of less than 500 miles to established railroad depots, river ports, and harbors. Its helicopter characteristics would make it possible for it to land and take off in small, unpaved sites.

'Instant' X-Ray Plate Can Be Used 10,000 Times

A new phosphor used to coat a simple metal-ceramic panel is the secret behind a new photographic plate which can be used 10,000 times and will give an immediate picture without any developing.

Developed by Thorn Electrical Industries Ltd. in England, the inexpensive electronic photographic plate is sensitive to light and invisible radiation. It appears to be most useful for recording transient x-ray images in hospitals, and for industrial use and research.

The new phosphor which is used is basically zinc cadmium sulphide. It glows in a direct current field when triggered by an external source of radiant energy. When the panel is energized in darkness, no light is emitted and the leakage current through it is extremely small. When light or other radiation triggers the electroluminescent mechanism, a yellowish glow appears. The image of an object placed on the panel will remain when the triggering radiation is removed and the object taken away. The image is said to remain sharp for about 30 minutes. When the D.C. supply is turned off, the image disappears and the panel may be used again.

Panels three inches by three inches, or six inches by four inches are available. Further information on the product can be obtained by writing H. Mehner, International Division, Upper St. Martin's Lane, London, W.C.2, England.

for the home

Makes Bathtubs 'Skid-Proof'

A new product called "Endslip," makes it possible to make a bathtub slip-proof in less than one minute, according to its manufacturer, Walter Lyons Drug & Chemical Co., East Boston, Mass. It is said to be invisible, harmless to skin and stain-proof, and it can be removed with any household detergent. It comes in a 12 oz. spray can. Additional information can be obtained from Eldon & Wade Co., 141 Milk St., Boston 7, Mass.

Swimming Pool Alarm

Aqualarm, a swimming pool alarm which sends a signal when a child or animal falls into the water, has been made available by U. S. Sonics Corp., 84 Sherman St., Cambridge 40, Mass.

The solid state device consists of a ceramic sensing element, which is placed in the water, and a receiving box. When someone, or something, falls in the water, the sensing device sends a signal to a pocket-size receiver, which sounds the alarm. The system is battery powered.

Traveling Toothbrush Clips On

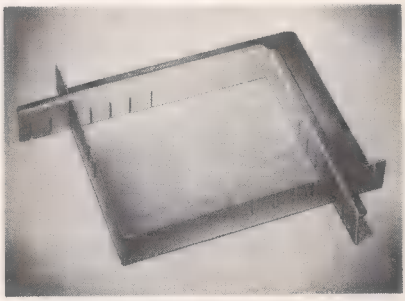
"Dial-On," a toothbrush that has a clip cap so that it can be carried in a pocket or a purse, is available from Maslon International Corp., 30 West 22 St., New York 10, N. Y. It has a barrel handle that can be filled with toothpaste. A dial at the top of the handle can be turned to force the toothpaste into the brush.

Frameless Picture Holder

A frameless picture holder which produces the effect of the picture's being part of the room, rather than appearing to be set off from the wall, has been designed by the Kurt Winkler Co., Frankfurt/Main, West Germany. The picture holder consists of a glass cover with honed edges, a white and black sheet of paper, and a back cover with clamps. The picture may be hung at from $\frac{2}{5}$ths to $\frac{3}{5}$ths of an inch from the wall.

Adjustable Baking Pan

By using the "Pic-A-Size" adjustable aluminum baking pan, housewives can bake cakes from four by six inches to 10 by 12 inches, or 47



The Pic-A-Size adjustable baking pan gives housewives a choice of more than 40 different sizes when baking a cake.

other sizes in between. Or, two cakes can be baked in the pan at the same time. The manufacturer is The Lighthouse, Inc., Dept. 85, Plymouth, Mass.

Another feature of the pan is that baked cakes can be slid directly onto the cooling rack or a plate. The "Pic-A-Size" pan can also be used for baking and roasting meats, fish and vegetables.

science toys

Student Radioisotope Kits

Two radioisotope kits suitable for high school level students' use are being offered by Abbott Laboratories, Oak Ridge, Tenn. The kits contain either two or nine of the more useful isotopes, each in 5 ml. of water and 10 ml. screw cap vials. In order to obtain the kits, a student must have the signature of his science teacher or the permission of his parents or adult lab instructor. An order form and bibliography of literature on various experiments that may be made with these kits can be obtained from the company at Oak Ridge. The quantities in these kits are generally licensed by the Atomic Energy Commission and no by-product license is required.

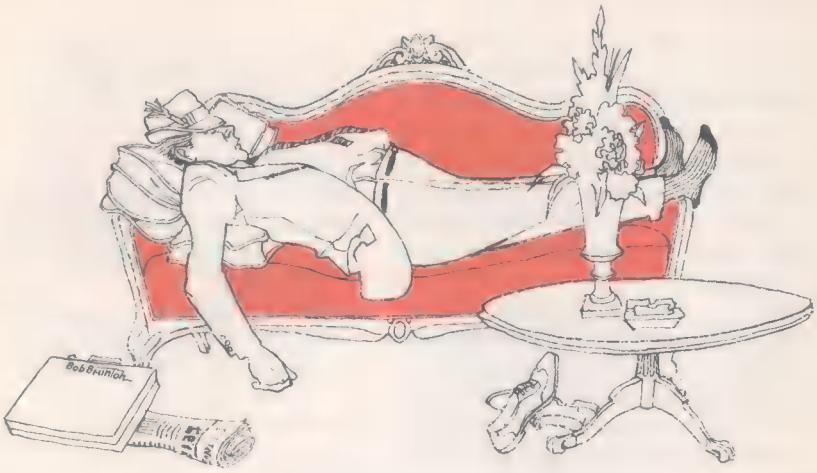
Multi-Microprojector

A versatile Multi-Microprojector has been introduced by the A. C. Gilbert Co., New Haven, Conn. Through it the user not only can view slides and specimens, but can project them on a screen. They can also be projected on a piece of paper for tracing, or tracings can be made by slipping a piece of paper over the face of the instrument, which has a calibrated scale.

The Gilbert Multi-Microprojector allows enlarging of almost anything of microscopic size and also serves as a projector.

Redesigned Chemistry Sets

A redesigned line of chemistry sets is being offered by Skil Craft Playthings, Inc., 325 W. Huron, Chicago, Ill. Some of the features of the sets are: a hydroponics set for soiless gardening experiments; a Spinthariscope; a molecular model set. Step-by-step manuals are included.



Why so many of us are tired

by Dr. John B. K. Smith and Robert Mines

You may be tired because your muscles are out of tone —or you may be suffering from guilt feelings.

OVER half the patients seen by American doctors complain of fatigue.

Every year doctors prescribe at least 3500 tons of amphetamine stimulants just to help their patients get through the day. Probably three time that amount ends up being sold illegally.

Why are so many of us tired? Is this feeling of tiredness purely physical or are psychological factors involved too?

Two of the most commonly cited causes of routine tiredness—vitamin deficiency and glandular disorder—are considered, by medical researchers, to be overstressed.

Most of us don't need to take vitamin pills regularly. A daily diet that is fairly properly balanced is likely to contain an adequate sup-

ply of vitamins. As far as our glands are concerned, disturbances of their functions are relatively rare.

Lack of exercise is much more likely to be truly important. However, being a muscleman is no proof against fatigue. Muscle tone counts more than muscle size. When tone is satisfactory, the muscle is both firm and elastic, capable of doing its work with the least strain and without undue fatigue.

Our exercise should be balanced. Authorities recommend about eight individual exercises, each related to a set of body muscles. Otherwise a person could spend a half hour on different exercises which would affect only one or two body areas.

People who find it hard to keep interested in exercises should try swimming (which provides the best all-around exercise), cycling, or walking at least one mile a day.

Our environment is important, too. Three factors affecting fatigue are:

1. Lighting. Most surveys show that over 50 percent of all offices have adequate lighting but too much glare, which can be just as tiring as dim light. In contrast, about 75 percent of the reading areas in homes are seriously underlighted.

Distracting noise creates a strain.

2. Atmospheric conditions, temperature, humidity, ventilation and air circulation.

3. Noise, the most underrated of the three. Distracting noise increases strain and makes us put forth greater energy to concentrate on whatever we are doing. Even noises to which we have become accustomed and no longer notice can drain our energy. Consider the student who claims he can study effectively while listening to the radio. Not only will he study less efficiently than he would in a quiet room, but he will tire himself more in the process. This is especially true if there are frequent commercials or much dialogue. Another fatigue-promoter is clutter. Some people bring this on by gathering all their work tools into too small an area, so that they won't "play themselves out" moving around after them. Often they only succeed in hampering themselves with increased confusion and frustration.

Dr. John B. K. Smith is Diplomate of the American Board of Psychiatry and Neurology, Associate Professor of Clinical Psychiatry, Seaton Hall College of Medicine and Dentistry and Clinical Director, New Jersey State Hospital, Marlboro, N. J.

Robert Mines is a clinical psychologist and Assistant Director of the Division of Mental Health, Alaska.

A small work area also discourages movement, and as physiologists have shown, maintaining a static posture for any period increases muscular strain. Thus we are likely to tire ourselves more standing quite still than if we spend the same length of time walking about a room.

Regardless of our surroundings, we hit our peak performance at our peak body temperature, especially when doing mental tasks or abstract reasoning. Scientists have long known that a person's temperature usually tends to fall when he goes to sleep and rise when he awakes. However, a person is not necessarily most energetic right after a long rest or a night's sleep. Every person is different. Research at the University of California shows that one person may reach his temperature and work peak shortly after he awakens, while another person may not hit his stride until several hours or more later.

Too long a rest

Short breaks are probably more refreshing than long rests anyway.

A too-lengthy rest period may actually increase our fatigue rather than dispell it, since the longer we are away from a job the more energy we may have to expend in "warming up" to it again.

This "warming up" process is closely bound up with the psychological factors in fatigue. Although they can tire us more than physical ones, we tend to overlook them while concentrating on the physical side.

Before being psychologically ready for a job we must (1) see it is worth doing, (2) be reasonably confident of success, and (3) want to do it now.

Because industry is so convinced that a worker's morale is important to his output, large companies put tremendous effort into meeting such conditions as these. Unfortunately, most of us either don't know of them or we ignore them in our own personal undertakings. One University of Chicago study shows that we never complete about 65 percent of the lengthy projects we undertake on our own. It's quite likely that putting more effort into selling ourselves on them before we even start these jobs would strikingly improve this statistic.

Once the job is started, there is a much better chance of finishing it if tiring monotony and boredom are relieved by varying effort. Dr. Lilian Gilbreth, the pioneer efficiency expert, found that "lengthy jobs usually involve a variety of facets. Ordinarily we don't have to complete one aspect of a job before going on to another. And if we make a switch every hour or so from one part of the job to another. we will usually not only relieve our fatigue but also vastly increase our persistence. This may well mean the difference between actually completing the job or abandoning it in a partially-completed state."

Instead of feeling relieved at giving up the job, a person may feel

so guilty that he loses his remaining energy. This close connection between guilt and fatigue is one of the most outstanding discoveries that researchers in human behavior have made in recent years. They have found that new drugs not only relieve feelings of depression but usually give the person involved considerably greater pep as well. The explanation probably is that in many cases of apparently inexplicable depression, our basic feelings are of guilt—which we may not want to face, but which are very much involved in our concept of ourselves. Our unhappiness with ourselves can rob us of much of our usual energy.

Unknown depression

"It is very probably true," says Dr. William Menninger, former president of the American Psychiatric Association, "that many people who tell their physicians they are always tired are more depressed than they know. Or they may attribute their depression to always being tired, when in reality the depression is the cause of the fatigue, rather than the result."

Here are three ways we cause guilt feelings in ourselves:

1. Putting things off. This takes more energy than "doing it now," since we not only have to put forth the energy the job would ordinarily require but also have it hanging over us—and causing us both frustration and guilt—until we do undertake it.

2. Hesitating too much over decisions. This is often only a disguised way of putting a thing off—and it usually has the same results.

3. "Letting George do it"—or otherwise rationalizing away our responsibilities. This can have the same effect as putting something off, except it may be worse. We may not be able to make it up to our own satisfaction, with the result that the guilt—and its fatigue—may persist for a considerable time.

The best preventive for such fatigue-arousing emotions is to live up to your responsibilities — and promptly. People who accomplish much often have the most energy, while those who do little frequently complain of excessive fatigue.

Hate can tire us out, too. Dr. F. N. Allen of the Lahey Clinic in Boston says, "Hating somebody all day is more tiring than laboring in the fields from sunrise to sunset."

That doesn't mean we should bottle up or attempt to ignore this kind of emotion. Neither approach gets rid of it. According to Dr. Menninger, the family that tries to avoid letting its own differences come to the surface is likely to be most chronically on edge.

If we feel we can't talk them out, there are other ways of ridding ourselves of such feelings. Studies conducted at San José State College have shown how effective many types of exercise are in discharging strong negative feelings.

Any type of exercise will help to some extent, but competitive activities are the best of all, since they

Games give us a chance to release emotions.

give us a chance to wear off our aggression and hostility in a socially acceptable way. These feelings can also be discharged through other competitive games—bridge, or whist or darts—or through creative activities which genuinely give expression to our own feelings.

These activities also provide us with interests outside our work.

Dr. Gilbreth once made a study of women industrial workers. All were in good health. They did much the same kind of work, under much the same physical circumstances. Yet they varied tremendously in the tiredness which they experienced at the end of each day.

Dr. Gilbreth concluded that those who still felt alive at the end of the day had something to look forward to either that evening or the next day, while those who were worn out didn't.

Finally, we need encouragement in whatever we do. When the physician Dr. Henry H. Goddard was on the staff of the Vineland Training School in New Jersey, he made frequent use of the ergograph—a device used to measure physical indications of fatigue. He discovered that when a staff member said to a youngster, "You're doing fine," the boy's energy-curve would soar. Discouragement and fault-finding invariably had the opposite effect.

We can't always count on others to encourage us, but we can use these three techniques to boost our own spirits:

1. Keep a daily graph—preferably on a large sheet of paper, posted near where you work—on which to regularly chart your progress. By dramatizing your accomplishment, it is likely to give your morale a boost every time you look at it.

2. After you have put in a couple of work sessions on any new project, make a schedule of the progress you feel you can realistically expect to attain. Then promise yourself some concrete reward—something that will be meaningful to you and that you genuinely want—every week or so, providing you either equal or surpass this schedule.

3. Making a point of talking over your project successes with others. Almost invariably, this will rekindle enthusiasm on your own part too. It is one of the finest ways of literally talking yourself into being enthusiastic about a job all over again. In short, almost everyone has a normal share of human energy. We get unduly tired only when we let it leak away needlessly.

New York's newest landmark

SWAYING on two catwalks garlanded over the tops of 70-story-high towers, workmen this July will finish stringing the wire for the longest suspended span in the world. It is the Verrazano-Narrows Bridge, which will swing across the entrance to New York harbor, a distance of 4,260 feet, 60 feet more than San Francisco's Golden Gate Bridge.

Stringing the wire is the first step in building the span itself. When that is finished, the pencil-thick galvanized wire will be squeezed and bound into cables. Each is a series of endless skeins anchored in concrete on shore and laid over the tops of the towers. To make a skein, 585 miles of wire are joined end to end. From the cables will be hung a six-lane upper deck, to be followed by a second six-lane deck later.

Ordinarily, a suspension bridge has two cables. An extra husky design gives the Narrows Bridge an annual capacity of 48 million vehicles; it has four cables each three feet in diameter. Not counting vehicles, the cables will have to hold a weight equal to the weight of the battleship Missouri and two destroyers.

The British engineer Thomas Telford hung the first long suspension bridge from iron chains in 1826. Later in the century John Roebling pioneered wire.

In Roebling's day, bridge building was costly in lives. His Brooklyn Bridge, completed in 1883, killed 20 men. At the half-way mark, deaths on the Narrows Bridge have been held to one. Construction men are hoping the new gateway to America will not be a memorial.

BOOKS

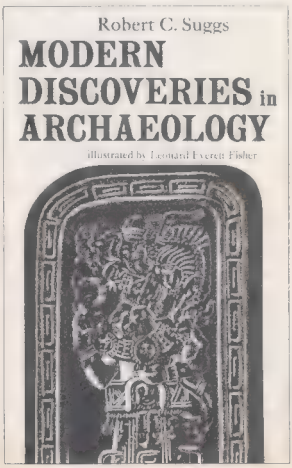
Benedict A. Leerburger, Jr.

A Treasury of Scientific Prose, edited by Howard Mumford Jones and I. Bernard Cohen. Little, Brown, & Co. Boston. 372 pp. ($6.75). Drawing from the rich library of British scientific writing during the nineteenth century, the editors of this book include in a single volume the work of such men as Darwin, Faraday, Paley and Davy.

Ranging from Faraday's "On the Chemical History of a Candle" to Brown's "Remarks on Active Molecules," these selections are models of scientific exposition that satisfy the specialist as well as the general reader. It is hard to dispute Professors Jones and Cohen who say that, "to anyone with an ear for prose cadence, a feeling for exactitude in language, and an interest in ideas, these selections ought to prove a delight, for they show how excellent a medium of expression English can be when it is written not by the aesthetically minded, but by mature men with something intellectual to present."

Soviet Science of Interstellar Space, by S. Pikelner. Philosophical Library, Inc. New York City. 230 pp. ($7.50). An interesting, fairly comprehensive survey of the rapidly expanding field of Soviet space science has been prepared under the direction of Academician V. G. Fesenkov of the University of Moscow. The engineer as well as the physicist, the trained layman as well as the theoretician, will find in this volume a valuable compendium to the method, the scope and the present status of Soviet research and planning.

Modern Discoveries in Archaeology, by Robert C. Suggs. Thomas Y. Crowell Co. New York City. 117 pp. ($2.95). A distinguished practicing archaeologist discusses a number of the most important archaeological discoveries of the last few decades. The frozen tundra of the Arctic Circle, the glaring deserts of Afghanistan, the tropical forests of Central America, have all yielded secrets of man's past. The author dwells on these subjects with the zest of a schoolboy. Although writ-



ten for young people, this book should be of interest to all.

THE FIRST BOOK OF WEEDS, by Barbara L. Beck. Franklin Watts, Inc. New York City. 66 pp. ($2.50). Although most weeds are plants that grow where we don't want them, some weeds are extremely useful. Miss Beck has written an informative book on these hardy and often annoying plants.

Brake Fern (The First Book of Weeds)

MATHEMATICS AND THE IMAGINATION, by Edward Kasner and James R. Newman. Simon & Schuster, Inc., New York City. 380 pp. ($1.95) Paperback. With wit and clarity, the authors of this delightful volume lure the reader into higher mathematics where the mind must transcend "common sense" and intuition.

After a brief and reassuring explanation of the new language of mathematics, the authors present the Googolplex—the largest definite number that anyone has yet bothered to conceive. From here the reader is taken on a trip past assorted geometries, and the land of gamblers where the dice-throwing and penny-pitching are given scholarly treatment and the serious business of probability is illustrated with playing cards. This is an easy book to read, and a hard one to put down.

Barbara L. Beck, left: Weeds can be useful.

James R. Newman, right: Math can be fun.

WILDLIFE'S TEN-YEAR CYCLE, by Lloyd B. Keith. University of Wisconsin Press, Madison, Wis. 201 pp. ($6.00). In an attempt to understand the periodic fluctuations of wildlife in Labrador and the Southern Arctic—known as the 10-year cycle—Dr. Keith has attempted to put into proper prospective several divergent schools of thought. His book is a scholarly work that should interest those concerned with wildlife and in particular the curious cycle of the North.

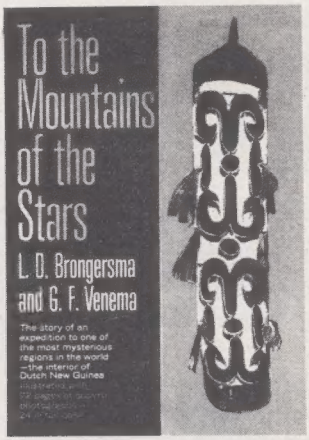
BUILDING WITH ELECTRONICS, by Harry Zarchy. Thomas Y. Crowell Co., New York City. 148 pp. ($2.95). This practical book shows how a knowledge of electricity can

be put to use. The projects described include building a rain alarm, an electronic metronome, an intercommunication system, an audio amplifier and a public address system.

ANIMAL BEHAVIOR, by John Paul Scott. Doubleday & Co., Inc., New York City. 330 pp. ($1.45) Paperback. Animal behavior has fascinated mankind ever since the days of Solomon and Aesop. Traditionally, people have been willing to learn from the grasshopper, the ant and the lion what they have refused to see in their fellow man. This book is written to answer the question: What is the modern science of animal behavior all about? Dr. Scott, a Senior Staff Scientist at the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me., provides a concise and accurate introduction to the subject of animal behavior.

THE SOCIOLOGY OF NATURE, by Leslie Reid. Penguin Books, Inc., Baltimore, Md. 288 pp. ($1.45) Paperback. Ecology is that branch of biology which deals with the relationship between organisms and their environment. It it the study also of rhythms and cycles in nature, of seasons and habitats, of why leaves fall in winter and why cacti grow in the deserts. It is these questions that Reid has chosen to answer in his book. Although the author lacks the poetry of Rachel Carson, he does a fine job of presenting the world of nature through the eyes of an experienced teacher.

TO THE MOUNTAINS OF THE STARS, by L. D. Brongersma and G. F. Venema. Doubleday & Co., Inc., New York City. 318 pp. ($5.95). A dangerous journey into one of the last unexplored areas on earth—Central Dutch New Guinea—where native Papuan tribes still live under Stone Age conditions is described in this book. The Dutch expedition of 1959 traversed uncharted jungles, rivers and mountains, making stopovers in the villages of the island's savage tribes. The story is well told and illustrated with many fine black and white and color photographs.



CANCER, by R. J. C. Harris. Pelican Books, Inc., Baltimore, Md. Paperback. 127 pp. $.95. Fear is often due to a lack of knowledge, and, in the case of cancer, to a misconception of the disease's nature. Dr. Harris describes the nature and possible causes of the various kinds of cancer. Unfortunately, *Cancer* reads more like a medical report than a basic discussion for the layman.

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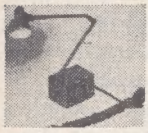

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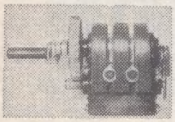

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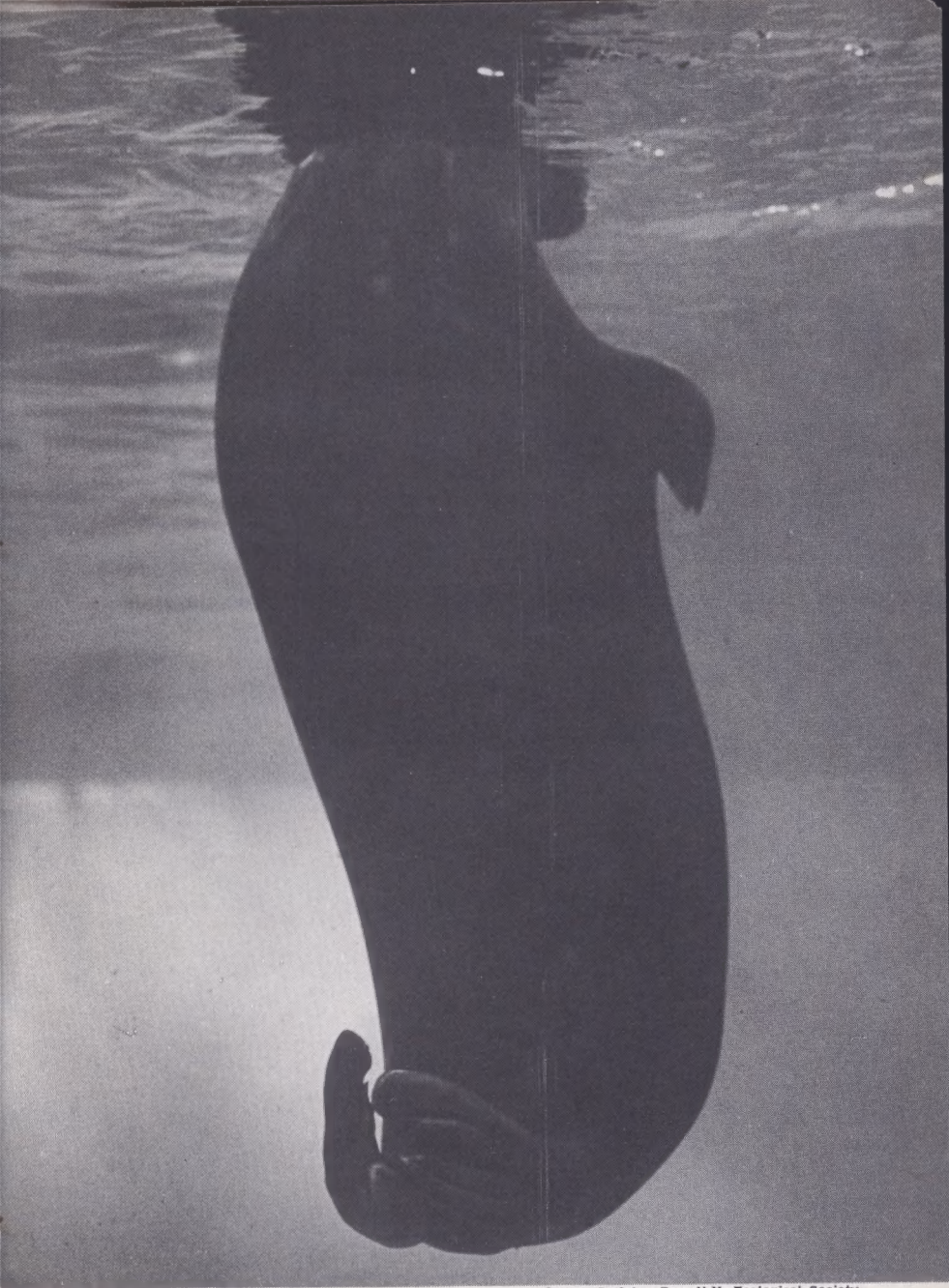

Carleton Ray, N.Y. Zoological Society

TALE WITHOUT A HEAD
At the zoo we have often seen a seal with just its head peering above the water. This gray seal was photographed from the other end.

Camera Hawaii

SCIENCE DIGEST

Instant dome

GEODESIC DOME-TYPE STRUCTURES are one of the coming things in architecture. They can be used for various purposes and can be put up quickly and easily. Perhaps that is why Henry Kaiser likes them. When he wanted a 2,000-seat auditorium built in Hawaii he wanted it done in five days. His aides taught Hawaiian workers the tricks of this type of construction in 15 minutes; 20 hours later the auditorium was up. What are some of the other coming things in this age of ever-expanding science and technology, and how will they affect you? For Kaiser's predictions see page 58.